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Training in Summarizing Notes: Effects of Teaching Students a Self-Regulation Study Strategy in Science Learning

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The University of San Francisco

TRAINING IN SUMMARIZING NOTES: EFFECTS OF TEACHING STUDENTS A SELF-
REGULATION STUDY STRATEGY IN SCIENCE LEARNING

A Dissertation Proposal Presented
To
The Faculty of the School of Education
Learning and Instruction Department

In Partial Fulfillment
of the Requirement for the Degree
Doctor of Education

by
Michelle Nebres
San Francisco
May 2016

THE UNIVERSITY OF SAN FRANCISCO

Dissertation Abstract

Training in Summarizing Notes: Effects of Teaching Students a Self-
Regulation Study Strategy in Science Learning

The last two decades of national data assessments reveal that there has been a sharp decline in nationwide standardized test scores. International assessment data show that in 2012 a very low amount of American students were performing at proficiency or above in science literacy. Research in science literacy education suggests that students benefit most when they are self-regulated (SR) learners. Unfortunately, SR poses a challenge for many students because students lack these skills. The effects of having learned few SR strategies at an early age may lead to long term learning difficulties—preventing students from achieving academic success in college and beyond. As a result, some researchers have begun to investigate how to best support students' SR skills. In order for studying to be successful, students need to know which SR study strategies to implement. This can be tricky for struggling students because they need study strategies that are well defined. This needs to be addressed through effective classroom instruction, and should be addressed prior to entering high school in order for students to be prepared for higher level learning.

In this study, students underwent a treatment in which they were taught a SR study strategy called summarizing notes. A crossover repeated measures design was employed to understand the effectiveness of the treatment. Results indicated a weak, but positive correlation between how well students summarized notes and how well they performed on science tests.

Self-regulation skills are needed because these are the types of skills young adults will use as they enter the workforce. As young adults began working in a professional setting, they will be expected to know how to observe and become proficient on their own. This study is pertinent to the educational field because it is an opportunity for students to increase SR, which affords students with the skills needed to be a lifelong learner.

This dissertation, written under the direction of the candidate's dissertation committee and approved by the members of the committee, has been presented to and accepted by the Faculty of the School of Education in partial fulfillment of the requirements for the degree of Doctor of Education. The content and research methodologies presented in this work represent the work of the candidate alone.

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May 13, 2016
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May 13, 2016

DEDICATION

My dissertation represents the intersection of my interest in pedagogical research and my commitment to ensuring that all students have obtained the skills needed in order to succeed academically. This dissertation is dedicated to my family:

To my husband JP, I cannot begin to express how much your support has meant to me through this endeavor. Thank you for being there for me, for being a wonderful husband, and for being my best friend. None of this would have been possible without you.

To my Mom, thank you for teaching me the value of education and for instilling in me: independence, tenacity, and perseverance. I am what I am today because of you. I hope I have made you proud.

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CHAPTER I: INTRODUCTION

In 2009, President Barack Obama asked the American education system to partake in reviving the creativity and advancement for American society through the use of critical thinking skills in the area of science (Niess & Gillow-Wiles, 2013). This subject is important because it may possibly have a solution to the global challenges such as energy efficiency, resource use, and environmental quality (Brown et al., 2011; Bybee, 2010; DeJarnette, 2012).

The growth of United States professionals who are becoming specialists in the science fields cannot compare to the growth of professionals seen in Europe and Asia. According to the U.S. Department of Commerce (2009), these occupations are projected to grow by 17 percent from 2008 to 2018. This estimates to be approximately 8,654,000 jobs by 2018. Despite this high demand, there are not enough students graduating from college with degrees in these fields. Approximately 1,000,000 high school students will declare an interest in a science, technology, engineering, or math, but more than half of those students will lose interest by the time they graduate (Munce, 2012).

The last two decades of national data assessments reveal that there has been a sharp decline in nationwide standardized test scores. More specifically, the Program for International Student Assessment (PISA) data show that in 2012 only seven percent of 15 year-old students are performing at proficiency or above in science literacy. These data indicate that the American educational system is failing to compete with other countries, and American students' performances in challenging subjects such as science is below average (Daugherty, 2013). This suggests that American students are struggling academically in science.

Research in science literacy education suggests that students benefit most when they are active, self-directed learners (Zimmerman, 2002). Someone who is self-directed is aware of his or her strengths and limitations (Zimmerman, 2002). He or she is able to monitor and reflect on their behavior and are able to determine if their goals are being met. These qualities are known as self-regulation (SR). Unfortunately, SR poses a challenge for many students because students have difficulty with self-direction (Zimmerman, 2002). Furthermore, the effects of having learned few SR strategies at an early age may lead to long term learning difficulties—preventing students from achieving academic success in college and beyond. As a result, some researchers have begun to investigate how to best support students' SR skills (Carroll, 2012; Brown, 2005; Hsiao, Tsai, Lin, & Lin, 2012; Kauffman, Zhao, & Yang, 2011; Milliano, van Gelderen, Sleegers, 2012).

Recent research supports that SR study strategies are effective and last even after the instructional support is taken away (Ness & Moore Sohlberg, 2013). There still remains a need, however, to demonstrate which SR study strategies may benefit struggling learners. Because SR study strategies requires intense cognitive processing, students may not know when or how to apply them if a task is too challenging (Lodewyk, Winne, Jameison, 2014; Ness & Moore Sohlberg, 2013).

In order for studying to be successful, students need to know which SR study strategies to implement. Teaching students how to study properly may help lead to better grades, which are important because grades are an indication of whether concepts have been learned (Yang, 2005). This can be tricky for struggling students because they need study strategies that are well defined (Lodwyk, Winne, & Jamieson-Noel, 2014). Although students have an awareness of what is demanded of them, they lack awareness of how to translate that understanding into proper plans

and execution (Lawento et al., 2013). This needs to be addressed through effective classroom instruction, and should be addressed prior to entering high school in order for students to be prepared for higher level learning (Lawento et al., 2013).

Students whose teachers employ study strategies differ from those who are rarely given instruction in study strategies (Moely, Hart, Leal, Santulli, Rao, Johnson, & Hamilton, 1992). Teachers who teach study strategies have a bigger impact on children's achievement and overall performance—especially for low and moderate achievers (Moely, Hart, Leal, Santulli, Rao, Johnson, & Hamilton, 1992). Studies have shown that there is a significant improvement in overall GPA, reading, science and social studies grades when taught study strategies (Beidel, Turner, & Taylor-Ferreira, 1999). Therefore, a combination of traditional teaching activities and teaching study strategies must be provided for better support.

During the elementary school years, students are becoming more aware of learning processes (Moely, Hart, Leal, Santulli, Rao, Johnson, & Hamilton, 1992). At this stage, they are learning how to make decisions that will benefit long-term learning (Son, 2005). Although some studies show that elementary students do not yet possess the ability to control how they study, other research has shown that they do have the ability when taught appropriately (Moely, Hart, Leal, Santulli, Rao, Johnson, & Hamilton, 1992; Son, 2005). It is a student's classroom environment that is a major contributor to study strategy acquirement; however, research shows that within a five day period, teachers rarely employ study strategies (Moely, Hart, Leal, Santulli, Rao, Johnson, & Hamilton, 1992; Son, 2005). This lack of emphasis on study strategies at the elementary age has shown to have an overall negative effect on students achievement in the secondary and postsecondary setting.

Self-regulation study strategies are considered important to possess. They provide skills needed to reach academic goals through a process of continuous organization and management of thoughts and behaviors within the academic environment (Ramdass & Zimmerman, 2011). Current research has observed that low-achieving students use few SR study strategies, which results in poor quality of learning while high-achieving students employ more SR study strategies between and within different contexts (Rueda & Genzok, 2007; Ruban & Reis, 2006). High-achieving students seem to be actively involved in their learning, whereas low-achieving students are unable to use or control SR strategies and continue to struggle academically (Ruban & Reis, 2006).

The most recent changes to the science standards, known as the Next Generation Science standards (NGSS), requires students to have a more active role in learning such as discovering, producing, and evaluating concepts (Yoon, 2009). These are processes that require SR study strategies rather than traditional learning methods such as simply memorizing scientific principles, laws, and theories (Yoon, 2009). According to a recent research report (Trystad, Smith, Banilower, & Nelson, 2013), elementary science teachers were asked about their beliefs in effective pedagogy. Ninety percent of these teachers agreed that each class session should conclude with a summarization of key ideas addressed in the lesson. They agree that having students summarize key ideas is an effective strategy, which leads to becoming a more active learner (Trystad et al., 2013). Summarizing and note taking are SR study strategies that are related to proficient academic performance and active learning (Ruban & Reis, 2006; Zimmerman, 2008).

Several studies have examined college students and the type of note-taking and study strategies they used. These studies indicated that summarizing notes has enhanced students' test

performance (Brown, 2005). By writing concepts over again, reducing the material to only the most important information, and by teaching these skills explicitly provides students with a way to enhance their studying (King, 2003; Makany, Kemp, & Dror, 2009; Van Zile-Tamsen, 1997).

Recent research indicates that different types of note-taking strategies have been successful, but what lacks in the research is an examination of the effect of summarizing notes on academic achievement (Boomer & Holliday, 2006; Boyle, 2011; Boyle & Rivera, 2012). Summarizing notes is a study strategy high-achieving students use in order to prepare themselves for a test. When students summarize notes, they go over their notes, re-write them, and leave out less important parts (Ruban & Reis, 2006). Furthermore, the majority of studies on summarizing and note-taking involve middle school, high school and undergraduate students, but few examine students at the elementary level. The traditionalist view of elementary school as a place where a student only learns content is outdated. Students also come to elementary school to learn how to learn, and it is a teacher's responsibility to provide these skills (Camahalan, 2006).

Purpose of the Study

The present study examines the effect of teaching students how to actively participate in their learning through the use of a key SR study strategy where they combine note taking and summarizing. This is called summarizing notes. The purpose of this study is to determine whether summarizing notes while learning science improves academic outcomes. The central variables of interest in this quasi-experimental study are science achievement, as measured by chapter tests in the fifth-grade district mandated science curriculum, instruction in summarizing notes, and implementation of the study strategy. It is hypothesized that summarizing notes will improve science achievement test scores, particularly for underperforming students, and that students may vary in their ability to implement the SR strategy.

Significance of the Study

This study is significant for several reasons. The first reason emphasizes the importance of adopting self-regulation strategies prior to entering high school. It is important to begin teaching these strategies at an early age because between the ages of eight and nine are the ages that students can begin to control their motivation, which is directly related to self-regulation (Sedova & Goryacheva, 2012). Brit Postholm (2010) concluded that significant learning is achieved when students are introduced to self-regulated learning strategies in the upper elementary grades. Introducing these learning strategies, and providing students with the knowledge on how to adapt these strategies with their learning has a positive relationship with academic achievement (Brit Postholm, 2010). When students are given the opportunity to practice and are exposed to these skills early, it improves their independent learning and these skills eventually improve over time; therefore, introducing self-regulation skills at an early age will set students with a foundation for independent learning by the time they reach the collegiate level (Rapp-Paglicci, Stewart, and Rowe, 2011).

The second reason reflects the high use of self-regulation skills in gifted students. Studies have concluded that gifted students have high use of self-regulation skills. Zimmerman and Martinez-Pons (1990) corroborated with other findings, which support the importance of self-regulation skills when it comes to academic achievement (Stoeger & Ziegler, 2005). Their study examined gifted students, and discovered that gifted students made greater use of their learning strategies when compared to non-gifted students (Zimmerman & Martinez-Pons, 1990). The findings of their study indicate that training students to be more independent learners can be accomplished by enhancing self-regulation skills. In addition, gifted students set goals for themselves, use many different learning strategies to achieve these goals, and closely monitor

their performance (Ruban & Reis, 2006 [Risemberg & Zimmerman, 1992]). Gifted students are very confident in their learning capabilities, curious about the world, are tenacious in difficult situations, and are committed to learning; however, these are the self-regulation strategies that low-achieving students lack (Ruban & Reis, 2006 [Risemberg & Zimmerman, 1992]).

Third, self-regulated learning has been used as an intervention to produce higher-academic achievement. For example, one intervention that has been successful is the reciprocal teaching method which allows students to act as teachers by self-questioning, summarizing, predicting, and clarifying text to increase reading comprehension (Rueda & Genzok, 2007). It has helped those who are considered academically low-achievers become high-achievers (Rueda & Genzok, 2007). In another study, which examined a training program that taught time management and preparing schoolwork independently, posited that teaching self-regulated strategies to underachievers resulted in a successful intervention (Stoeger & Ziegler, 2005).

Lastly, this study was formulated under the strong correlation between self-regulation and academic achievement in science (Dibenedetto & Bembenuitty, 2011). The recent reforms in education are emphasizing a change in the approach to science learning. The new approach is based on the perspective of students playing a more active role in their learning. The recent changes to state standards require a more active role in learning such as inquiry based learning (Yoon, 2009). This approach to science involves discovering, producing, and evaluating. These are processes that require self-regulated strategies rather than learning through traditional methods such as simply memorizing scientific principles, laws, and theories (Yoon, 2009). These traditional methods are outdated and no longer align with the new state standards.

Theoretical Framework

The theoretical framework draws on Zimmerman's model of self-regulation and its role in learning.

Zimmerman's theory of self-regulation. Self-regulation (SR) processes are used to support the attainment of a goal through activating and sustaining thoughts, behaviors and emotions that promote its achievement (Zimmerman, 2008). The main concepts behind self-regulation are a) knowing, b) initiating, c) adapting, and d) persevering a strategy to the correct context (Zimmerman, 2008). Self-regulation is the ability to problem solve, and to understand when, where, and why specific strategies are used. It involves using and connecting background knowledge, self-monitoring performance, and motivation (Rueda & Genzok, 2007; Gagne, Yekovich, & Yekovich, 1993; Pressley & McCormick, 1995).

Students who are highly self-regulated are aware of how to self-manage and how to enact specific skills in the correct contexts in order to improve academic achievement (Hodges & Kim, 2010). Successful self-regulators are self-directed, and carefully select processes to enhance their academic performance (Zimmerman, 2002). A self-regulated learner is one who takes initiative without instruction, can use appropriate SR strategies, and continually uses these SR strategies such as organizing and managing their thoughts, emotions, and behaviors to succeed in their learning environment (Bandura, 1996; Rueda & Genzok, 2007; Ramdass & Zimmerman, 2011; Carroll, 2012). Having the ability to control and develop these skills will help support and direct student learning, which eventually will lead to becoming an independent, proactive learner (Boekaerts & Cascallar, 2006).

Zimmerman's (2002) model of self-regulation posits three cyclical phases: the forethought phase, the performance phase, and the self-reflection phase with each phase made of

two sub-phases as seen in Figure 1. The forethought phase is composed of task analysis and self-motivation. Task analysis involves goal setting and strategic planning. Learners are successful when they set goals for themselves and when they plan how to reach that goal while self-motivation provides them with their own personal beliefs and capabilities related to learning (Zimmerman, 2002). The performance phase is composed of self-control and self-observation. Self-control is the actual use of strategies a learner had planned to use during the forethought phase. Self-observation is when a student keeps track of whether or not the strategies they have decided to use were successful showing an outcome, and the cause of the outcomes (Zimmerman, 2002). Lastly, the self-reflection phase is comprised of self-judgment and self-reaction. Self-judgment is the act of comparing one's performance against a standard, including knowledge of the cause of an error or the cause of success. Self-reaction is the feeling of self-satisfaction, which can be either: a defensive or adaptive. A defensive reaction is when one chooses to avoid an opportunity to learn while an adaptive response is when one chooses to modify a strategy that was ineffective (Zimmerman, 2002).

Study strategies arise from all phases of SR. However, this present study focuses on strategies, which emphasize the self-control portion of the performance phase. Self-control is the use of imagery, self-instruction, attention focusing, and task strategies selected during the forethought phase to perform the goal oriented learning. The type of self-control method that will be deployed to guide students toward independent learning is summarizing notes--a task strategy to enhance learning (Zimmerman, 2002).

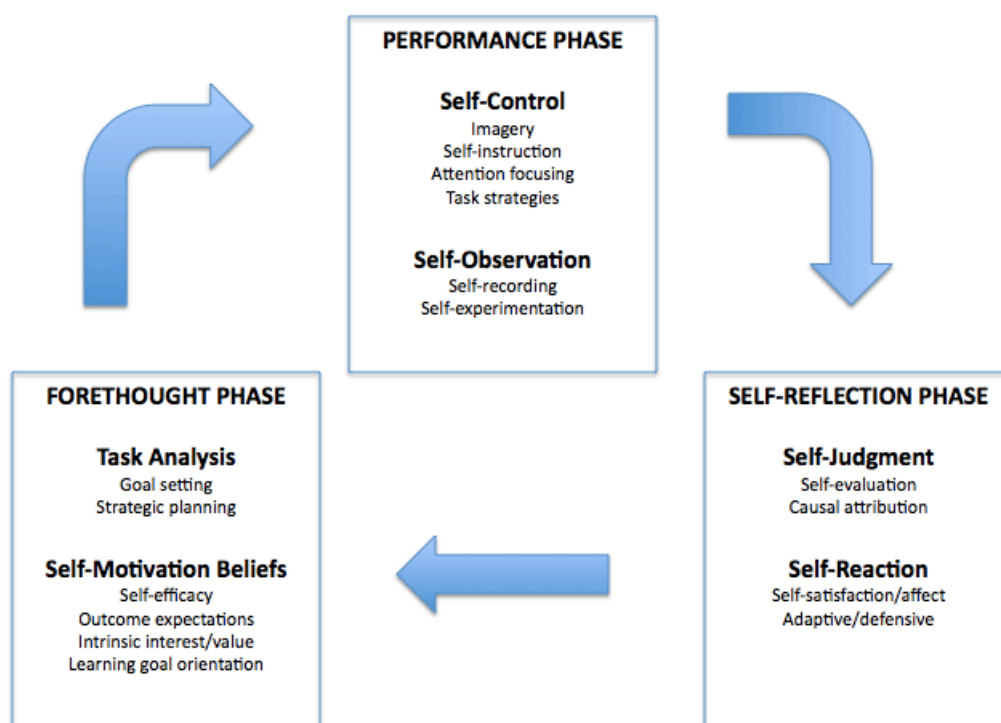


Figure 1. Zimmerman's cyclical model of self-regulation.

Background and Need

Summarizing. Summarizing has been defined as an activity that involves the creation of a short statement that is an extraction of a larger piece of information (Yu, 2013). It is a reflection of the gist, central ideas, or consolidated version of another piece of writing (Hidi & Anderson, 1986; McAnulty, 1981; Yu, 2013). A summary reproduces all the significant facts, such as the main ideas and supporting details, of the original piece, but omits unnecessary information (McAnulty, 1981). Being able to create a more concise and generalized form of a piece of writing is an activity that requires organization and the integration of ideas.

Summarizing allows the learner to build relationships between concepts and to focus on the important ideas, which in turn facilitates comprehension of the text (Leopold & Leutner,

2012; Westby et al., 2010). Furthermore, when students determine what is important (and what is not important) can reveal whether or not comprehension has actually taken place (Williams, 2011). Summarizing requires students to use prior knowledge to extract key ideas from the text and to construct connections between those key and supporting ideas, and then consolidate that information into an overall central idea (Williams, 2011). Summarizing involves the most advanced levels of reading and writing skills, which supports the comprehension process—the ultimate goal of literacy.

Kintsch (1989) proposes that the task of summarizing is beyond just recalling information. Summarizing challenges the simple recall method because students must be concise in what they select to be important, appropriate information. That is, summarizing requires students to be concise with their words, and explicit attention is needed to select the appropriate information; the learner must understand and integrate the individual sentences, words, and features of the text, to form the relationship to global concepts (Kintsch, 1989). Summarizing is a learning strategy that helps readers focus on essential information (Westby et al., 2010). Skilled readers know how to summarize. It is an essential process to learning because it involves higher order processes such as main idea comprehension, discourse synthesizing, and an integration of reading and writing (Yu, 2013). Summarizing, synthesizing, and integrating information are the types of processes students will need to develop as they mature. The ability to write summaries of texts is critical in the context of writing academic essays, literature reviews, and reports—genres of writing required throughout high-school and beyond.

Note taking. Note taking is defined as the process of capturing key ideas and concepts in a condensed format (Ruban & Reis, 2006). It serves two primary purposes as a study strategy: to encode material into long-term memory and to impact achievement (Kauffman, Zhao, & Yang,

2011). Note taking is a popular learning strategy and is often encouraged by teachers because it helps students to comprehend and organize information, thereby preparing them for performance on assessments (Bonner & Holliday, 2006). Note taking helps sort unimportant from important information and reveal the relationships between main ideas and supporting details. It also facilitates studying because it focuses students' attention, aids learning of the text, and promotes retrieval (Brown, 2005).

The format of note taking can either be linear or non-linear (Beesley & Apthorp, 2010). Linear note taking is a more traditional method, whereby information is organized with hierarchical structure such as when using an outlining method (Kauffman et al., 2011). This hierarchical structure of the outline method sometimes organizes topics under a corresponding roman numeral with relevant details included underneath (Kauffman et al., 2011). By contrast, non-linear note taking is considered a less traditional method that may be organized in a matrix, or a table formatted with topics along the top row, repeatable categories down the left-most column, and details in the intersecting cells (Beesley & Apthorp, 2010; Kauffman et al., 2011). Note taking can either be guided by the instructor or may be used independently (Beesley & Apthorp, 2010). Guided note taking provides students with support needed to distinguish between essential and nonessential information. Some educators provide students with guided note taking to ensure that key concept and ideas are recorded (Beesley & Apthorp, 2010).

Combining summarizing and note taking. There are a variety of different types of study strategies, but research primarily focuses on college students and shows that the more common and successful strategies are summarizing and note taking (Davis and Hult, 1997). For example, Davis and Hult (1997) examined 90 college students who either a) took notes and wrote a summary at the end of the lecture, b) took notes and wrote a summary during pauses in

the lecture, or c) took notes without a summary. Their study showed that students who took notes and wrote a summary during pauses in the lecture received higher scores on the immediate posttest compared to students who wrote summaries at the end of the lecture. Furthermore, a meta-analysis conducted by Beesley and Apthorp (2010) found that students who use note taking and summarizing consistently performed better on academic assessments than students who did not take notes, and that, applied separately, the effects of note taking and summarizing are consistently positive across subjects and grades. However, King (1992) reports that college students who studied for an exam via summarization recalled more content and outperformed students who only reviewed notes (King, 1992). Therefore, one gap in the research is how to teach and combine the two strategies, summarizing and note taking. This study will determine whether summarization in combination with note taking as a learning strategy will support science learning.

Self-regulation study strategies. Summarizing and note taking are categorized as self-regulation study strategies. Self-regulation study strategies support the attainment of high academic achievement through continuous organization and management of thoughts, emotions, and behaviors (Zimmerman & Ramdass, 2011). These strategies are not static, but can be improved over time with exposure, and practice (Rapp-Paglicci, Stewart, & Rowe, 2011). Knowing how to enact SR study strategies enable students to a) focus, b) sustain attention, c) contemplate options, d) formulate plans, e) monitor progress, and f) adapt behaviors based on the surrounding environment. These can be developed in order to guide and direct learning, independent of the teacher (Boekaerts & Cascallar, 2006; Ruban & Reis, 2006; Rueda & Genzok, 2007).

Ruban and Reis (2006) identify the differences in SR strategies between low and high achieving students. They hypothesized that low-achieving students have not been taught the proper study strategies needed in order to become successful in school and have poor study habits, thereby attaining below average grades and below average standardized test scores (Camahalan, 2006; Lee, Lan, Hamman, & Hendricks, 2008; Ruban & Reis, 2006;). Conversely, a high-achieving student is one who uses efficient study strategies, possesses good study habits, maintains a B+ or higher in coursework, and scores above average on standardized tests (Camahalan, 2006; Lee et al., 2008; Ruban & Reis, 2006). Although SR strategies are not the epitome of success, it is theorized that these strategies do support overall academic success. The following section delves deeper into self-regulation theory.

Self-regulation study strategies are related to academic outcomes (Zimmerman, 2002), which is a relationship that has been studied extensively at the college level and to some degree at the high school level; because we know from this literature that successful high school and college students employ SR strategies, it stands to reason that teaching young students to summarize their notes would enhance performance in elementary school and prepare them for future educational success.

College study strategies. Strategies learned (or not learned) in elementary school can have a long-term effect on academic success. Prior academic performance and test scores are traditionally used to determine whether a student should be admitted into an institution of higher education (Crede & Kuncel, 2008). Yet, some students who are deemed qualified based on these measures still underperform in college. One explanation is that students vary in their use of effective study strategies (Crede & Kuncel, 2008; Moely et al., 1992; Rachal, Daigle, & Rachal, 2007). Some strategies students have difficulty with are a) remaining focused and attentive while

studying, b) remembering information for tests, c) taking notes, and d) comprehension (Rachal, Daigle, & Rachal, 2007). Students report that reading textbooks tends to be a very slow process and the notes taken while reading assigned chapters are often disorganized, making them too difficult to understand (Rachal, Daigle, & Rachal, 2007). Yet, the ability to read and synthesize difficult texts is needed to perform well in higher education.

Time spent studying, the strategies employed, and academic grades are all interrelated (Nonis & Hudson, 2010). Ironically, students who spend less time studying a good set of notes do significantly better compared to students who spend more time studying and who also had access to a good set of notes (Nonis & Hudson, 2010). Although this seems counterintuitive, this finding suggests that given a good set of notes results only in higher grades if the study time is spent efficiently (Nonis & Hudson, 2010).

A repercussion of the lack of SR study strategies taught at the elementary level is underperforming college students; thus, more universities are requiring freshman to take a form of developmental education. The primary goal of developmental education is to teach effective study strategies (Mireles, Offer, Ward, & Dochen, 2011). Empirical evidence suggests that developmental education is successful in relation to future academic performance (Crede & Kuncel, 2008; Mireles, et al., 2011). Measures of University students' study strategies show a positive relationship with academic performance, similar to the traditional predictors of academic performance, which are prior performance and admission tests scores (Crede & Kuncel, 2008). However, although institutions of higher education are responding to this need with developmental coursework, the fact remains that students are coming into college without the skills for success.

High school study strategies. More and more high school students are choosing to attend college, but are unprepared for the academic challenge (Duggan, 2009; Kayler & Sherman, 2009). Researchers also found that although public school students have good intentions to study, there is a disconnection between actual study time and final test performance because students are studying easier items longer than difficult items (Sussan & Son, 2014). Sussan and Son (2014) infer that even highly motivated students may not know how to apply SR study strategies to their study behaviors, thus negatively impacting final performance.

To help students, some public high schools implemented a variety of study skills programs (Kayler & Sherman, 2009). For example, one study skill program was instituted during the second semester of ninth grade in a suburban public high school located in the southeastern United States. Participants were chosen because their GPA situated them at the bottom 50 percent of their class. The program consisted of meetings that focused on time management, homework, study strategies, test-taking strategies, test anxiety reduction, and organization. At the conclusion of the study, students reported that they were using more study strategies by the end of the program. However, when examining GPA there were no significant mean differences from their initial GPA from those that had not participated in the program (Kayler & Sherman, 2009). Therefore, study strategies are needed prior to entering high-school level as well.

Elementary study strategies. The research on college and high school students inform SR study strategies in younger children. Self-regulation study strategies can be taught to students at any age. However, there is a lack in the core curriculum to teach SR study strategies at the elementary level. The standards driven curriculum, which requires elementary students to learn certain information before entering the next grade, necessitates that elementary school teachers predominantly engage in traditional teaching activities. These include asking children for correct

answers, acknowledging correct responses, describing procedures, and telling students specific, topical information concerning during each lesson (Moely, Hart, Leal, Santulli, Rao, Johnson, & Hamilton, 1992).

During the elementary school years, students are becoming more aware of learning processes (Moely et al., 1992). At this developmental stage, they are learning how to make decisions that will benefit long-term learning (Son, 2005). Although some studies show that elementary students do not yet possess the ability to control how they study, other research shows that they do have the ability when externally directed (Moely et al., 1992; Son, 2005). A student's classroom environment is a major contributor to study strategy acquisition (Moely et al., 1992; Son, 2005). Similar to Moely et al.'s (1992) finding of 2.28 percent of classroom time is spent on study instruction, Ness (2011) observed twenty classrooms for a total of 3,000 minutes of which 3.4 percent was used to teach the study strategy of summarizing. In addition, when all of the percentages were aggregated by grade level, Ness (2011) found that fifth grade only used the study strategy of summarizing 2.8 percent of the time. This lack of emphasis on study strategies at the elementary level is likely to have negative lasting impact on student achievement as they progress to the secondary and postsecondary setting. Therefore, a combination of traditional teaching activities and instruction in study strategies must be provided for overall support.

Overall, the transitions students make from elementary to high school and from high school to college are difficult ones, and in both cases teaching consistent study strategies may be the key answer. This current study examines a SR study strategy at the elementary level, which would presumably inform future academic success in high school and college. Teaching these skills at an early age is expected to be helpful because students of this age are learning how

to self-regulate their everyday behavior (Sedova & Goryacheva, 2012). Thus, introducing study strategies and providing students with the knowledge on how to adapt these strategies at an early age has a positive relationship to academic achievement (Brit Postholm, 2010). When students are given the opportunity to practice and are exposed to these skills early, it improves independent learning (Rapp-Paglicci, Stewart, & Rowe, 2011). As students grow older, these skills will improve over time. It will set students with a foundation for independent learning by the time they reach the collegiate level (Rapp-Paglicci, Stewart, & Rowe, 2011). However, the type of study strategies that need to be taught need to be further investigated.

Science Achievement. Science achievement has been a systemic problem for American education (Banilower et al., 2012; Romance & Vitale, 2012). Although there have been numerous attempts to raise student achievement, international and national reports show that these attempts have been unsuccessful (Romance & Vitale, 2012). A lack of instructional time has been identified as a main issue science education (Romance & Vitale, 2012). Thus, an incorporation of a literacy approach to science to improve reading comprehension of science texts and raise science achievement has been the focus of recent studies (Lara-Alecio, Tong, Irby, Guerrero, Huerta & Fan, 2012; Romance & Vitale, 2012; Norten-Meier, Hand, & Ardasheva, 2013).

In sum, recent research indicates that different types of note taking strategies and summarizing have been associated with student learning---in middle, high school, and college students (Bonner & Holliday, 2006; Boyle, 2011; Boyle & Rivera, 2012). Summarizing notes appears to be a study strategy employed by many high achieving students in order to prepare for a test. However, to my knowledge, little is known about the effort of training in summarizing

notes on achievement—particularly in younger children. The current study examines the effect of training in summarizing notes on fifth grade science achievement.

This current study would provide a foundation for designing and implementing an effective intervention that may enhance study strategy use among students at low achievement levels. A low achieving student is one who is at-risk academically and fails to meet minimum academic standards during the school year (Ruban & Reis, 2006).

Research Questions

Research Question 1: What are the effects of Summarizing Notes on students' End of Chapter science test scores?

Research Question 2: What are the effects of Summarizing Notes on low achievers' End of Chapter science test scores?

Research Question 3: What percentage of students scored needs improvement, making progress, proficient, or advanced when Summarizing Notes?

Research Question 4: Do the Summarizing Notes performance scores correlate to End of Chapter Test scores?

Research Question 5: What were students' perceptions of the Summarizing Notes activity?

Definition of Terms

Throughout the literature related to self-regulation, achievement, and study strategies there are terminologies that have been defined in varying ways. For the purposes of the proposed study, the following definitions are provided and are the ones that will be used in this study.

High Achieving Student is someone who maintains a B+ or higher in his or her courses, and scores above average on standardized tests (Ruban & Reis, 2006).

Low Achieving Student is someone who is at-risk academically, and who fails to meet minimum academic standards during the school year (Ruban & Reis, 2006). This is represented by below average grades and below average standardized test scores (Ruban & Reis, 2006).

Science End of Chapter Test is a 20-question test that measures how much information a student has acquired from the school district's adopted curriculum.

Self-regulation: A self-directive process by which learners transform their mental abilities into academic skills (Zimmerman, 2002).

Study Strategy is a process that enhances the effectiveness and efficiency of student learning (Gettinger & Seibert, 2002).

Summarizing is the deleting of material that is trivial. Deleting material that is redundant. Substituting a superordinate term event for a list of items or actions, and selecting a topic sentence (Westby et al., 2010).

Note taking is consciously selecting and recording important from unimportant information, and allows for a rephrase of important points of a lecture or reading (Boyle & Reivera, 2012).

CHAPTER 2: REVIEW OF THE LITERATURE

Many study strategies support academic achievement, and although the literature on improving student achievement covers a wide variety of strategies, this review will focus on two main study strategies, summarization and note taking (Boyle & Rivera, 2012; Brown & Day, 1983; Garjria and Salvia, 1992; Horney et al., 2009; Malone & Mastropieri, 1992; Nelson, Smith, & Dodd, 1992; Solis et al., 2012). Although these study strategies are typically investigated as separate entities and applied to a variety of achievement contexts, the current study will primarily focus on their application as one, integrated single study strategy, in the context of fifth grade science achievement.

This study focuses on the fifth grade population, but the literature examined discusses includes college and high school populations as well. This is due to college and high school populations being more readily accessible to researchers. This study aims to extend the research that shows self-regulation study strategies, which promote academic success in college students and has been taught to students at the high school level, to examine whether these study strategies can be taught at the developmental level of fifth grade.

This chapter first evaluates previous work examining the efficacy of summarization skills on student achievement. Then, the effectiveness of note taking using methods such as Guided Note Taking and Strategic Note Taking will be covered. Next, an explanation on instructional praxis between science and literacy is formulated. Lastly, a discussion of SR research and its relationship to study strategies ends this section.

Study Strategies and Self-Regulation

Many studies have found that self-regulation (SR) study strategies bolster academic achievement and high achieving students have been found to adopt a significantly higher use of

SR strategies in comparison to low achieving students (Hartwig & Dunlosky, 2012; Nandagopal & Ericsson, 2012; Ruban & Reis, 2006). The SR strategies used by high achieving students are likely to benefit their achievement because these methods require students to process deeply, thus, internalizing information. Therefore, if high achieving students seem to naturally regulate their learning, can under performing students be taught SR study strategies. The following studies examine the relationship between SR and study strategies.

More and more high school students are choosing to attend college, but are unprepared for the academic challenge (Duggan, 2009; Kayler & Sherman, 2009). Recent research shows that this is due to lack of and/or inconsistency with prior preparation in study activities (Duggan, 2009). Duggan (2009) surveyed 121 recent high school graduates' precollege experience and preparation while enrolled as first semester community college students, which showed that those who attended private school or were home schooled felt that they had above average study strategies. Approximately sixty-six percent of private school students felt they had above average study strategies while only 25.8 percent of public school students felt that they had above average study strategies. Based on these findings, it seems that public school students are in need of more support with preparing for the academic demands instituted by postsecondary education.

Researchers also found that although public school students have good intentions to study, there is a disconnection between actual study time and final test performance because students are studying easier items longer than difficult items (Sussan & Son, 2014). Sussan and Son (2014) examined high school students and actual study time. They found that students were studying easier items for longer periods of time, $M=2.86$ seconds, compared to difficult items, $M=1.59$ seconds (Sussan & Son, 2014). When studying, a learner must determine how well the information has been learned and how to acquire the knowledge that is missing – key processes

in SR study strategies. Based on their findings, Sussan and Son (2014) infer that even highly motivated students may not know how to apply SR study strategies to their study behaviors, thus negatively impacting final performance.

Although students also need to be taught how to study, the amount of time spent teaching study strategies is often minimal. Moely et al. (1992) conducted observations of 69 elementary teachers. Each teacher was observed for 300 minutes. They found that teachers' suggestions for study strategies occurred only 2.28 percent of the time (Moely et al., 1992). Furthermore, students whose teachers employ study strategies--methods and techniques used by students to improve learning--differ from those who are rarely given instruction in study skills (Moely et al., 1992; Rachal, Daigle, & Rachal, 2007). A second experiment was conducted to examine the achievement levels of students when experiencing a teacher with lower levels of strategy instruction versus a teacher with high levels of strategy instruction. Moely et al. (1992) found that children who had a high strategy teacher showed a significant increase in performance from pretest to posttest ($F(1,35) = 56.40, p < .0001$), while students who had a low strategy teacher did not show high achievement gains ($F(2,23) = 12.02, p = .0003$). Therefore, teachers who teach study strategies may have a bigger impact on children's achievement and overall performance—especially for low and moderate achievers (Moely et al., 1992). Studies have shown that there is a significant improvement in overall GPA, reading, science, and social studies grades when taught study strategies (Beidel, Turner, & Taylor-Ferreira, 1999).

Another study by Guthrie, Klauda, and Ho (2013), which examined an SR study strategy was also effective. Guthrie, Klauda, and Ho (2013) studies how summarizing instruction that consisted of locating keywords and supporting facts in a text ranging from one paragraph to a section of a chapter to a whole chapter of a textbook affected learning (Guthrie, Klauda, & Ho,

2013). Students wrote summaries of two or three sentences, which increased in length as students read longer texts (Guthrie, Klauda, & Ho, 2013). The authors developed the Informational Text Comprehension (ITC) assessment to measure understanding of science texts on animal and plant survival after instruction (Guthrie, Klaudia, & Ho, 2013). They also used the Motivation for Reading Information Books in School (MRIS-S) questionnaire to measure motivation. The data analysis showed that there were increases in motivation, engagement, and achievement (Guthrie et al., 2004).

More recently, a comparison of SR study strategies between 49 low and 131 high achieving university students, data showed that low achieving students are inefficient at studying because they use strategies that are superficial, relying on surface processing with information not deeply internalized (Ruban & Reis, 2006). An example of surface processing is reviewing notes, because it does not lend itself to formulate knowledge, while high achieving students tend to reorganize notes, which forces a formulation of knowledge thereby processing information in a deep manner. Researchers also identified SR strategy patterns among students. Using the Learning Strategies and Study Skills Survey (LSSS) to measure academic behaviors, the authors categorized the SR strategies into categories founded by Zimmerman and Pons (1986). The original categories totaled 14, however, Ruban and Reis (2006) consolidated the categories to eight a) self-evaluating, b) managing time and redistributing workload, c) organizing and transforming material, d) structuring environment, e) memorizing, rehearsing, and retaining material, f) reviewing records and clustering material, g) utilizing support networks, and h) non-strategic behavior.

According to the LSSS, all of the students used many strategies when studying, however, the top five strategies used by low achieving students differed when compared to high achieving

students. Thirty-six percent of low achieving students used a flashcard creation strategy to support their learning, 24 percent relied on reviewing notes, and 18 percent used allocation of study time. Memorizing and seeking assistance from others were reported to be equal in low-achieving students with a total of 14 percent. All of these strategies are considered surface processing (Ruban & Reis, 2006). On the other hand, 32 percent of high achieving students used summarizing notes as the most used SR study strategy, while 24 percent created mnemonic devices and visual cues to aid in learning. Seventeen percent of high achieving students used a routine memorization strategy. Lastly, 13 percent thought about their approach to learning by examining what the teachers wanted and then what they want to come away with from the course (Ruban & Reis, 2006). These strategies are considered deep processing methods (Ruban & Reis, 2006).

Using strategies that fall under the SR category of organizing and transforming material were the most beneficial of all strategies examined. (Ruban & Reis, 2006). High achieving students were found to have significantly more use of strategies such as these, which lend themselves to meaningful learning and subsequent academic achievement. The authors also concluded that the amount of study time was not as important as how study time was used (Ruban & Reis, 2006). Furthermore, the SR study strategies of low achieving students largely contained surface processing strategies, shown to be very superficial and likely did not allow for meaningful learning. The authors suggest that low achieving students could be redirected (taught) to incorporate SR study strategies in order to be a skilled learner.

In a similar study by Nandagopal and Ericcson (2012), an analysis of low (n=21), average (n=17), and high achieving (n=22) college students showed that those who attained higher grades used a larger number of different study strategies to aid in their academic performance. The SR

categories used most were organizing and transforming material, utilizing support networks, and reviewing records (Ruban & Reis, 2006; Nandagopal & Ericsson, 2012).

Initial student interviews used questions adapted from the Self-Regulated Learning Interview Schedule (SRLIS) designed by Zimmerman and Martinez-Pons (1986), which focused on study strategies they typically used. The interviews were then coded into one of the SR categories (Zimmerman & Martinez-Pons, 1986). Students were also given a diary template to fill out, which asked them to write detailed information about their study activities, which they filled out daily. To determine how much student performance was based on strategy use, authors used linear regression with semester GPA as the dependent variable, and strategies were entered as the independent variable. Analysis shows that the strategies accounted for 51 percent, a significant portion of the variance in grades (Nandagopal & Ericsson, 2011).

In corroboration with the findings of Ruban and Reis (2006), students who received higher grades had a larger number of strategies they used to study and were more likely to engage in deep processing strategies such as those found in the SR categories of organizing and transforming information, seeking information, and reviewing materials (Nandagopal & Ericsson, 2012).

Overall, these studies focus on postsecondary education and conclude that elementary public school students are in need of better preparation for the expected academic demands in college. Teaching students effective SR study strategies is one possible way to combat this issue. However, these studies focus on such SR study strategies at the college level not at the elementary level (Moely et al, 1992). This current study will focus on providing elementary students with a SR study strategy that can be used independently throughout any academic stage.

Literacy and Science

This section discusses the role of literacy in science education to provide the background for note taking and summarizing in the context of science. The studies reviewed below support the conclusion that science lessons, which incorporate literacy, such as instruction in reading comprehension and writing, facilitate science learning. Romance and Vitale (2012) developed a study in which they examined a cognitive science and literacy instructional model over the course of a school year. This particular model integrated science with reading and writing at the elementary level. Students were taught core concepts in science for 45 minutes during each school day. Teachers used classroom instruction in which students worked in large and small groups to explore topics, and teachers integrated science, reading, and writing as a way to enhance these concepts. Hands-on experiences, journal writing, concept mapping, cumulative review, reading comprehension, and application activities were activities used as a course of study.

Romance and Vitale (2012) reported mean differences of a cross-sectional longitudinal study in grades three through five on two different achievement scales the Metropolitan Achievement Test (MAT) and the Iowa Tests of Basic Skills (ITBS). The reported results indicated that fifth grade students who were labeled at-risk increased their scores on the MAT (2.3 adjusted mean difference) and on the ITBS (.51 adjusted mean difference). These scores were based on 15 classes of fourth and fifth grade students who received the science literacy training for five months.

The following year, Romance and Vitale (2012), examined 45 classes of fourth and fifth grade students, who were labeled either regular or at-risk, and used this same model for a total of 12 months. The results of their scores were encouraging, with an adjusted mean difference of

1.11 on the MAT and an adjusted mean difference of .37 on the ITBS. A treatment and grade level interaction was found with an adjusted mean difference of +.72 in grade two. This study also examined 12 other schools for multiple years, and found an adjusted mean difference of +.38 on the ITBS Science and an adjusted mean difference of +.32 on ITBS Reading. Based on this data, the authors argue that increased duration of instruction utilizing integration of science and literacy will result in larger gains in science and reading proficiency. Although the ITBS doesn't appear to follow the patterns of large gains, the authors can still argue that there is a valid change in test scores (Vitale & Romance, 2012).

Another study by Lara-Alecio et al. (2012) examined fifth grade science and literacy achievement using a similar approach as Vitale & Romance (2012) with a sample of 166 students in the treatment group and 80 students in the comparison group. Students were categorized as English Language Learners (ELLs) or non-ELLs who were identified as low socioeconomic status (SES). Students were given a total of six tests throughout this study. The intervention introduced students to inquiry-based learning, direct and explicit vocabulary instruction, an integration of reading and writing, technology enriched lessons, science activities conducted at home, and mentoring by university students (Lara-Alecio et al., 2012).

This intervention included two components professional development for teachers and an 85-minute daily science instruction. During professional development teachers reviewed and practice upcoming lessons, discussed concepts, reflected on student learning and pedagogical progress, and ESL strategies. The science instruction component included the 5-E instructional cycle: engage, explore, explain, evaluate, and elaborate, with explaining as the essential portion of the 5-E instructional cycle. During this period, teachers focused on vocabulary development and extension through reading expository text to improve understanding of science concepts.

Students were given direct instruction on vocabulary words and then asked to partner read expository text. Upon completion of the reading, partners were given scripted questions to help aid in comprehension. Teachers reviewed these questions with the class to clarify misconceptions. Students were also asked to integrate writing with the 5-E cycle via structured notebooks that included predictions and observations, diagrams, figures, vocabulary, and a section where students wrote postcards, articles, or reflections. This instructional strategy is important to note because it contains two components, explaining and elaborating, which are directly related to summarizing (Brown & Day, 1983; Garjria & Salvia, 1992; Herbert, Gillespie, & Graham, 2013; Neson, Smith, & Dodd, 1992).

Based on results of three district wide tests and the state mandated scores, students in the intervention group showed significant improvement in science achievement. Positive effect sizes were found for the treatment condition versus the comparison group on the benchmark science tests. For tests two, four, and six, students in the treatment group showed effect sizes of 0.178, 0.194, and 0.195, respectively with an average of 87 percent passing in the treatment groups compared to an average of 78 percent passing in the comparison group. However, the Texas Assessment of Knowledge and Skills (TAKS) scores did not show statistically significant differences between groups. The treatment group had an average passing rate of 78.2 percent, while the comparison group had an average passing rate of 84.6 percent. The authors argue that the benchmarks assessments were a better indicator of student improvement because they were proximal assessments compared to the TAKS, which was a distal assessment (Lara-Alecio et al., 2012). However, to summarize, students who were taught the 5-E instructional cycle: engage, explore, explain, evaluate, and elaborate did significantly better on the district tests.

A similar study was conducted in 102 fifth grade students in two classrooms using a science and literacy method known as the Science Writing Heuristic (SWH) approach, an approach conceptualized by Keys, Hand, Prain, and Collins (1999) (Cavagnetto, Hand, & Norton-Meier, 2011). The SWH approach uses science investigations through the use of dialogue, reading, and writing. Students make claims and gather evidence from their investigation of these claims in order to encourage development of critical thinking and problem solving skills (Norton-Meier, Hand, & Ardasheva, 2013). They then compared their ideas with others, discuss what they have discovered, and examine how their ideas have changed after their investigations.

To assess student achievement, the authors collected data using scores from the Iowa Tests of Basic Skills Science (ITBSS). Student test scores were taken from 2005 and 2006 in order to examine whether students made gains. Test scores indicated no statistical significance, but test scores did increase slightly in both classrooms. The first classroom showed a mean score of 202.87 in 2005. In 2006, the mean changed to 226.00. The second classroom showed a mean of 206.12 in 2005, which changed to a mean of 228.08 in 2006.

Another study which examined a science and literacy approach, Concept Oriented Reading Instruction (CORI), was conducted by Guthrie et al. (2004). This research concluded that students who were taught using an integration of science and literacy scored higher on comprehension tests compared to students who learned through traditional instruction.

The authors analyzed scores from a pre and posttest passage comprehension and the Gates-MacGinitie Reading Comprehension Test. Based on the results of the study, students learned how to organize the knowledge in ways that facilitated retrieval and application of information (Donovan, Bransford, & Pellegrino, 1999). Thus, classroom activities that use CORI

as a foundation for teaching may provide the support and development students need to be successful independent learners.

During this study examining how CORI influenced learning, students were taught how to summarize and integrate information from different sources such as illustrations, references, informational texts, and literature (Guthrie et al., 1996). The Maryland assessment was used to measure achievement. Authors analyzed the data for reading, writing, literacy number one (sum of reading and writing), language use, literacy number two (sum of reading and writing, and language use), science, social studies, and math. An analysis of variance for literacy number one shows a significant effect of CORI compared to traditional instruction $F(1, 145) = 4.31$ (Guthrie et al., 1996). The analysis of literacy number two also showed a significant effect compared to traditional instruction $F(1, 142) = 5.17$. The authors concluded that these strategies supported student increase in literacy.

In conclusion, these studies support an integration of reading, writing, and science activities. The research indicates that teachers should move away from content-driven instruction and propose to create experiences where students have to use an integrated literacy approach to science learning. Although these studies provide support regarding an integration of reading, writing, and science, what these studies lack is establishing the specific components indicating which particular literacy activity is most beneficial for students to use independently. This proposed study will examine a specific literacy activity to provide students with an adequate tool to be an independent learner.

The Effectiveness of Summarization

Learning how to summarize is an essential skill for students. It has been found to be one of the most effective strategies that aid in learning (Brown & Day, 1983; Nelson, 1992; Solis,

Ciullo, Vaughn, Pyle, Hassaram, & Leroux, 2012). It is well understood that summarization is a learning tool thought to be equal to or better than other study strategies because it supports comprehension. The following research studies report on learning summarization skills.

A seminal study by Brown and Day (1983) established the basic rules of summarization that remain tenets for its application in present day. Brown and Day (1983) found that students as young as fifth grade were able to delete trivial and redundant information. However, substituting a category name for a list or also referred to as subordination proved to be difficult for fifth graders when compared to seventh, tenth, and college students. Fifth graders also had difficulty with inventing a topic, while seventh, tenth, and college students were more successful. This led Brown and Day (1983) to put forth four basic rules of summarizing a) delete unimportant information, b) delete redundant information, c) substitute a category name for a list (subordination), and d) invent a topic sentence. Their findings provided a foundation of summarization rules that persist in the literature (Brown and Day, 1983; Nelson, 1992).

Nelson, Smith, and Dodd (1992) built on the rules of Brown and Day (1983) in their qualitative study of a remedial education clinic. Because these students were mandated to receive special education services 50 percent of the day in a resource setting, this qualitative study was conducted as an education clinic; therefore, examining only five fifth grade students. These students were taught how to summarize using Brown and Day's (1983) four-step method. They were instructed to read a science text and to use a summary writing guide to write down the important things the writer said about the main idea (delete unimportant information), identify the important ideas, and to decide on a main idea or topic (invent a topic sentence). The summary writing guide contained nine steps, and then, students were asked to revise their summary based on feedback from a classmate. Two scorers predetermined which information

presented to the students was classified as important. The summaries were then evaluated prior to and after training by computing the percent of important information contained within each summary: number of important items found in the student's summary divided by the total possible number of important key facts, multiplied by 100. Reading comprehension was also assessed using a 10-item multiple-choice test developed by the teacher. Percent correct scores were compared before and after experiencing the summarization training.

Results show that there was an increase in the percentage of important information included in the summaries and reading comprehension also increased when the summary skills strategy was taught. Among these five students, Nelson, Smith, and Dodd (1992) found that students completed an average of 85 percent and 96 percent of the steps included on the summary skills guide, respectively. Further, scores on the reading comprehension test significantly improved after the summary skills strategy was taught. After the treatment, there was an average increase of 40 to 50 percent of important information included in summaries and for items scored correct on comprehension tests.

One student, known as Jamal, began with a baseline of 20 to 50 percent of important information included in summaries and for items scored correct on comprehension tests. After the treatment, Jamal's scores changed to 80 to 100 percent. Another student named Enrique had a baseline of 40 to 60 percent for important information included in summaries and for items scored correct on comprehension tests. After the treatment, Enrique's scores changed to 80 to 100 percent. The other three students showed similar results. Nelson, Smith, and Dodd (1992) concluded that the summary skills strategy used in his intervention improved comprehension of science text because it helped students to monitor their learning.

Other studies have also used the summarization rules founded by Brown and Day (1983). For example, Garjria and Salvia (1992) included a treatment condition whereby students were taught how to summarize through explicit modeling, guided practice, and independent practice and adhere to the basic rules of summarization as put forth by Brown and Day (1983) deletion of unimportant information, deletion of redundant information, generalization of lists (superordination), selection of a topic sentence, or the creation of a topic sentence that did not exist (invention). By the end of the treatment students were independently summarizing, with students in the treatment group who were taught to summarize outperforming students in the control condition on two measurements. The first measurement tested for main ideas, cause and effect, concepts, and inferences. The other tested for factual questions. The effect size between the treatment group and the control group on the first and second measurement were $ES = 6.66$ and $ES = 1.98$, respectively.

In another study, researchers examined three treatment conditions: summarization, summarization training with a self-monitoring cues, and traditional reading comprehension instruction (Malone & Mastropieri, 1992). The summarization training with self-monitoring cues employed a strategy that had students ask themselves two questions at the end of each paragraph: 1) who or what is the paragraph about and 2) what is happening. Scores on posttests evaluated both near and far transfer. Results for the near transfer showed that summarization had an effect size of 1.56 compared to summarization with self-monitoring cues, which resulted in an effect size of 1.53. However, there were conflicting results in the far transfer tests. The summarization effect size was 1.28 compared to the summarization with self-monitoring cues, which showed an effect size of 2.12. Overall, summarization shows to be effective when specific instructional praxis are taught.

Including the two studies above, a meta-analysis by Solis et al. (2012) examined study strategies that were most effective in reading comprehension, with seven of the 12 studies focused on summarizing, to provide intervention for 410 middle school students (grades six to eight) over a span of 30 years. Across studies, results indicated that the most effective instructional practices utilized main idea or summarization strategies that emphasize identifying the main idea of a text and linking those main ideas to other paragraphs to create summaries.

Not all findings support the idea that summarizing is the key skill to enhance learning. Herbert, Gillespie, and Graham (2013) conducted a meta-analysis, to determine whether some writing activities were more effective than others in improving comprehension for students. Several writing activity comparisons were examined across studies, utilizing students in grades five to 12, however their analysis did not reveal a specific writing activity that was found to enhance reading comprehension over the other activities. The authors suggest that this lack of differentiation may be due to a lack of statistical power, given the low amount of studies included within each comparison.

Despite the potentially underpowered analyses, results from Herbert and colleagues (2013) still indicated, albeit with small effect sizes, that summary writing was likely to be the most effective learning strategy. In the first comparison, Herbert, Gillespie, and Graham (2013) examined summary writing versus answering questions with students in fifth to twelfth grade. The summary writing condition included creating summary maps, one sentence summaries of each paragraph, an outline of the reading followed by a summary, and summaries of passages. The answering questions task not only included answering short questions in writing, but also generating questions about the passage. While the effect size of 0.24 was not statistically significant, all five studies in this comparison trended toward summary writing as a beneficial

strategy to aid in comprehension as compared to the answering questions activities. A second comparison was conducted to examine summary writing versus note taking. Because only four studies were available for this comparison, average effect sizes could not be computed and definitive conclusions could not be drawn. However, in three of the four studies, summary writing was favored as a learning strategy as opposed to note taking. Taken together, the implication of these comparisons is that summary writing is likely to enhance student comprehension better, and support student learning most effectively, than other activities, including note taking, extended writing activities, and answering questions.

Looking across the studies reviewed, teaching students how to summarize is successful and the distinguishing feature is that students are connecting ideas or identifying unifying themes in a lesson. If we assume the success of summarizing lies in the connection of ideas or in identifying unifying themes, then one can implement these as a praxis, which can be applied within the summarization methods of a) deleting unimportant information, b) deleting redundant information, c) substituting a category name for a list (subordination), and d) inventing a topic sentence.

The Effectiveness of Note Taking

While note taking may not be as effective as summarizing recent research suggests that it uniquely affects learning (Boyle & Rivera, 2012). Note taking methods reviewed here are Guided Note Taking and Strategic Note Taking (Boyle, 2011; Boyle & Rivera, 2012). These methods have been found most effective in science achievement. Boyle and Rivera (2012) argue that students should begin learning note taking in upper elementary grades because, at that developmental stage, teachers can heavily influence how students record information. They assert that learning note taking at this age also helps them to understand why recording

information is vital to learning; however, it needs to be done through specific modeling, guided practice, and independent practice.

The aim of Boyle and Rivera's (2012) meta-analysis was to discover which note taking interventions were feasible for underperforming students (students with learning disabilities), and how effective these interventions are on achievement. The interventions were performed in a specific content area that was presented via a teacher lecture. In this way, the emphasis for each intervention was on extracting information from lectures versus extracting information in written form using students who are not at grade level standards. The researchers found that students who were taught note taking techniques performed well on curriculum assessments.

The note taking training for each study ranged from one to three sessions, and each session was three weeks in length. Seven out of the nine studies used a review session as part of its note taking procedures, which typically lasted 10 minutes each. The assessments were 10 to 30 questions in length varied in type such as fill-in-the-blank, true/false, matching, and short answer. Other achievement measures were used such as immediate free recall and long-term free recall. In seven of the studies, researchers assessed the quality (accuracy of what was recorded) or quantity (number of words) of student notes.

The note taking interventions included Guided Note Taking, Strategic Note Taking, and Directed Note Taking. Guided Note Taking utilizes teacher prepared outlines of the content and contained designated spaces for students to record specific information. The Guided Note Taking included a short form, where one to three essential words were missing, and a long form, where four to eight words were missing. Strategic Note Taking provides student with specifically formatted paper that included prompts such as recording three to six main lecture points, recording new vocabulary, or summarizing lecture points. Directed Note Taking incorporates the

split-page format, self-questioning before, during, and after the lecture, and explicit instruction from the teacher, as well as guided and independent practice. Each group of students received one of these three interventions, or performed traditional note taking, across the studies in the meta-analysis. The strategies are similar because they require students to extract pertinent information, but they are slightly different because the intervention method requires students to connect and integrate knowledge.

In general, Boyle and Rivera (2012) found that students who were taught these specific note taking techniques performed better on tests and quizzes, exhibiting medium (0.70) to large (0.82) effect sizes when compared to those who used traditional note taking methods. The researchers also found that Guided and Strategic Note Taking were most effective on tests and quizzes compared to Direct Note Taking (Boyle & Rivera, 2012). Although this meta-analysis was conducted using students with disabilities, the authors advised that future research should include studies that pertain to general education classrooms.

Furthermore, the results of a similar study conducted by Boyle (2011) corroborate with the findings of Boyle and Rivera (2012) that Strategic Note Taking is more successful than traditional note taking (Boyle, 2011). In Boyle's (2011) study, mainstream middle school students ($n=76$) were asked to take traditional notes using a blank piece of binder paper, while the experimental group was asked to take notes using paper that was formatted specifically for Strategic Note Taking and consisting of several different sections: 1) today's topic 2) description of prior knowledge 3) three to six main points 4) a summary of how the ideas are related, and 5) new vocabulary. The experimental group was explicitly taught how to take notes using this Strategic Note Taking paper over four sessions.

Three types of measurements assessed the effect of Strategic Note Taking. Long-term free recall assessed students two days after viewing the videotaped lecture, where students were asked to write down as many facts, vocabulary, and ideas within a five-minute period as they could. The comprehension test included a 15-point multiple-choice test, which was developed from the information from the videotape. Finally, a questionnaire that included six statements with a four-point Likert-type scale pertaining to the helpfulness of Strategic Note Taking on remembering information and improvement of science grade was only administered to the treatment group. The results indicate that teaching middle school students how to take notes in a specific manner positively affects their overall comprehension and long-term recall. The results of the Strategic Note Taking questionnaire showed the highest rated items to be: I like Strategic Note Taking better than previous note taking, Strategic Note Taking helped me to record better notes, and Strategic Note Taking will help me improve my grades (Boyle, 2011). This study extends the research by providing support that teaching students how to strategically take notes improves comprehension, improves long-term recall, and students are able to record more lecture points (Boyle, 2011).

In contrast to studies by Boyle and colleagues (Boyle, 2011; Boyle et al., 2012; Horney et al., 2009), one study found that fifth grade students failed to produce original summaries when they were asked to summarize paragraphs as a form of note taking (Horney et al., 2009). Students read science text and took notes using an electronic reading system. Analysis reflected student gains in science knowledge when using the electronic reading system; however, summarizing was difficult for a majority of the students. In both conditions, they were asked to summarize each paragraph of the science text. To determine the quality of student summaries, measurements included a multiple-choice test with five questions on each test. Each question

was scored as one point. There were also short answer questions using a four-point rubric: no answer (0 points), answer incorrect (1 point), answer partially correct (2 points), answer generally correct (3 points), and answer correct (4 points). Researchers used a randomized, counterbalanced crossover design where individual students in each participating classroom were randomly assigned to either Group A or Group B. Students in both groups experienced both conditions. Only 26.3 percent of the students were able to write summary paragraphs in their own words. Post-summary, each student sat for a multiple-choice test to determine mastery of the summarized content.

The authors argue, however, that although students failed to produce original summaries (as a form of note taking) does not necessarily mean that note taking was not effective. The data suggests students who made the most gains were students who copied one sentence from each paragraph. The authors stated that these students were able to identify which sentence to copy, which suggests a high level of thinking about the text. Although this is not what was expected, it does provide justifiable information.

In conclusion, Strategic Note Taking has repeatedly been an effective study strategy during lectures (Boyle 2011; Boyle et al 2012), but what lacks in the literature is whether using Strategic Note Taking is beneficial when students are required to extract information via textbooks. This current study aims to investigate whether using Strategic Note Taking, used as a method to summarize notes to extract information from a textbook, will provide elementary students with a study strategy that is effective.

Summary

To sum up, SR study strategies have shown to be positively effective in student achievement. SR study strategies are deep processing methods that are often used by high-

achieving students, while low-achieving students rely largely on surface processing strategies of study (Ruban & Reis, 2006; Nandagopal & Ericsson, 2011; Hartwig & Dunlosky, 2012).

Furthermore, the literature on SR learning suggests that both summarization and note taking positively affect test scores, particularly for science content in the middle grades. The literature reviewed proposes that educators can create experiences where students use literacy to learning science content because this approach has shown to be successful with fifth grade students.

Summarization and note taking have improved both reading comprehension and overall academic achievement. Research has also shown that high-achieving college students combine these two strategies (summarization and note taking) into one to prepare themselves for a test (Beesley & Apthorp, 2010; Nandagopal & Ericsson, 2011; Ruban & Reis, 2006). However, less is known about how the instruction in summarizing and note taking can be combined to enhance science learning for elementary children.

CHAPTER 3: METHODOLOGY

The purpose of this study was to explore whether Summarizing Notes can improve fifth grade science achievement, particularly for underperforming students with weaknesses in Self-regulation. There are five research questions in this study:

Research Question 1: What are the effects of Summarizing Notes on students' End of Chapter science test scores?

Research Question 2: What are the effects of Summarizing Notes on low achievers' End of Chapter science test scores?

Research Question 3: What percentage of students scored needs improvement, making progress, proficient, or advanced when Summarizing Notes?

Research Question 4: Do the Summarizing Notes performance scores relate to End of Chapter Test scores?

Research Question 5: What are students' perceptions of the Summarizing Notes activity?

Research Design

The study employed a crossover repeated measures design (see *Figure 2*). Students underwent a treatment in which they learned a self-regulation study strategy called Summarizing Notes. This design was used to ensure that both Classroom A and Classroom B received the treatment (Summarizing Notes) and the non-treatment (traditional method), which could yield a more efficient comparison by reducing between-subject variability.

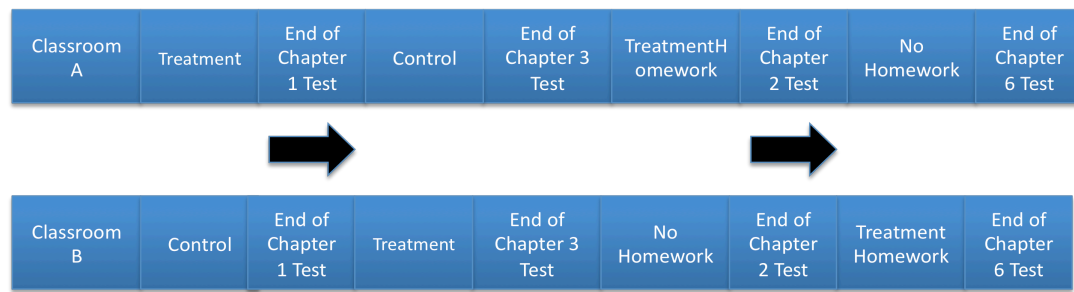


Figure 2. This figure illustrates a crossover repeated measures design.

Participants

Two teachers from a Northern California suburban school were selected to participate in this study. These teachers are referred to as Teacher A and Teacher B throughout the course of the study. Teacher A corresponds to Classroom A, while Teacher B corresponds to Classroom B.

Teacher A is a male teacher who has been an elementary school teacher for approximately nine years. He has taught Kindergarten, second grade, fifth grade, and sixth grade. Teacher A has a Bachelor of Arts degree in Education, a Multiple Subject California Teaching Credential, and a Master of Arts degree in Educational Technology. He also has an Administrative Tier 1 credential and is certified in Crosscultural, Language, and Academic Development. Teacher A enjoys teaching the upper elementary grades.

Teacher B is a female teacher who has been teaching for 29 years. Over the 29 years, she has taught 4th, 5th, and 6th grade, including numerous combination classes. Her educational background includes a Bachelor of Arts in English, a Multiple Subject California Teaching Credential, and a Master of Science in Educational Leadership. She is certificated in Gifted and Talented Education and Crosscultural, Language, and Academic Development. Teacher B also has an Administrative Tier 1 credential. Teacher B enjoys teaching the fifth grade.

These teachers were chosen due to their teaching experience. These teachers have many years of experience teaching the content used in this study.

The data in this study came from fifth grade students at a suburban elementary school of Northern California. The elementary school includes grades prekindergarten through sixth-grade. The total school enrollment was 600 in 2014-2015, with an ethnic composition as follows: one percent Pacific Islander, one percent American Indian, two percent African American, seven percent multi-ethnic, 10 percent Filipino, 16 percent Caucasian, 23 percent Latino, and 40 percent Asian. The school's English language learner population is 29 percent. Special education students make up roughly 11 percent of the school's population. According to the National Center for Education Statistics, a school that garners a population of 25.1 to 50.0 percent socioeconomically disadvantaged (SED) students is considered a mid-low poverty school. The school's SED population is 38 percent. It is a school that has a diverse learning community because of its composition of different ethnicities and cultural background.

The participant sample included approximately 60 fifth grade students. These students were a convenience sample and represented a broad range of achievement levels. Student data was excluded if they did not have parental consent, were new to the country, or were receiving special education services. The total enrollment in Classroom A was 30 students. The ethnic diversity of students in Classroom A was comprised of two percent Filipino, 13 percent Latino, 15 percent Caucasian, and 70 Asian. The total enrollment in Classroom B was 29 students. The ethnic diversity of students in Classroom B was comprised of three percent Filipino, 13 percent Caucasian, 15 percent Latino, and 69 percent Asian. The percentage of socioeconomic disadvantage students in each classroom is information that cannot be disclosed.

Protection of Human Subjects

A revised application for this project was been approved with the Institutional Review Board for the Protection of Human Services at USF. At the launch of the study, the legal guardians of the participants read and signed consent forms (Appendix D). Students read an assent form as the researcher also orally described their rights as participants. Parental consent and participant assent were obtained through written correspondence for participants in the study. The data of students who did not have parental consent or did not give assent was exempted.

Study documents utilized identified codes with a separate document linking the study code to the subject were kept in a separate location with restricted access to the researcher. All data and documents were limited to access by the primary investigator and participating teachers.

Variables

The variables of interest in this study were science grades, science achievement, and the Summarizing Notes study strategy. Each variable is explained below in turn.

Dependent Variables

Science Achievement. Science Achievement was measured by four End of Chapter Tests in Houghton Mifflin's Science book that was the book mandated/adopted by the school district. The End of Chapter Tests are part of the California Science (Houghton Mifflin, 2007) adopted curriculum (see Appendix), which was designed to be administered to students in fifth grade. These assessments were created to provide teachers with a way to summatively assess student progress throughout the school year. All tests scores were entered as a percent correct unless otherwise noted.

The chapters that students studied were very similar in structure. Each chapter consisted of two to three lessons and vocabulary words that are appropriate for fifth grade students. The chapters provided labeled diagrams, tables, and pictures that support understanding and comprehension. Every lesson began with an overview sentence that states the main idea and ends with a visual summary. The information covered in all the chapters are state mandated; therefore, students are required to learn the information in these chapters by the end of the fifth grade.

The End of Chapter Test for Chapter 1 (cells) consisted of 10 vocabulary questions followed by 10 short answer questions. The short answer questions required students to analyze, evaluate, synthesize, and apply what they had learned. Chapter 3 (body systems) also contains ten vocabulary questions, but only consisted of seven short answer questions and three multiple-choice questions. The short answer questions required students to analyze, evaluate, synthesize, and apply what they had learned. The End of Chapter Test for Chapter 2 (plant cells) included one question which required students to interpret data from a table. There were two true/false vocabulary questions, two short answer vocabulary questions, and ten short answer questions that required students to infer, compare, draw conclusions, apply, and synthesize. The End of Chapter Test for Chapter 6 (weather) included 10 fill in the blank vocabulary questions, four multiple choice questions, and six short answer questions. The short answer questions required students to analyze data, predict, compare, evaluate, synthesize, and analyze. All test scores were entered as a percent correct.

Science Chapter 1 End of Chapter Test. The End of Chapter Test for the first chapter (cells) consisted of 10 vocabulary questions followed by 10 short answer questions (Appendix J). The short answer questions required students to analyze, evaluate, synthesize, and apply what they had learned. Scores could range from 0 to 100% correct.

Science Chapter 2 End of Chapter Test. Chapter 2's test (plant cells) contained one fill in the blank, two true/false vocabulary questions, two short answer vocabulary questions, and 10 short answer questions (Appendix K). Scores could range from 0 to 100% correct.

Science Chapter 3 End of Chapter Test. Chapter 3's test (body systems) also contained ten vocabulary questions, but only consisted of seven short answer questions and three multiple-choice questions (Appendix L). Scores could range from 0 to 100% correct.

Science Chapter 6 End of Chapter Test. The End of Chapter Test for Chapter 6 (weather) includes 10 vocabulary questions, four multiple choice questions, and six short answer questions (Appendix M). Scores could range from 0 to 100% correct.

Student Summaries. To assess the quality of students' adoption of the summarization study strategy, student work under the treatment instruction was collected. This work was analyzed using a rubric, developed by a nearby Northern California School district, that rates the quality of summarization within student work on a scale of one to four (Appendix G). This rubric was developed to provide support for teachers to analyze assessment results and to create structures and processes for reviewing student progress and identifying strategies that address student needs.

Independent Variables

Classroom. This variable denotes the student's classroom, Classroom A and Classroom B.

Summarizing Notes. Summarizing Notes is a self-regulation study strategy that teaches students to connect the information they are learning to prior and new knowledge. In this study, students learned how to extract important concepts/topics and write down key information about those concepts from reading a chapter in the textbook. When students completed taking notes,

they wrote a summary reflecting the concepts/topics and details from their notes. The summary included a topic sentence, details, and a conclusion. Participants engaged in four tasks: with Summarizing Notes, without Summarizing Notes, with Summarizing Notes as homework, and without Summarizing Notes as homework. The treatment description is described in more detail below.

Science grades. Student rating of low, middle, or high was based on current science grades. Scores ranged from 0 to 100 and were recoded into categories: high (80-100), middle (60-80), and low performance (0-59). These categories are used by the district to determine report card grades. The table below shows the amount of students in each category.

Table 1

Number of Students in Each Performance Category Based on Current Science Grades

Performance Category	Classroom A N = 26	Classroom B N = 19
Low	11	9
Middle	10	7
High	5	3

Treatment Description

The following table provides a week by week overview of how the treatment was implemented.

Table 2

Dissertation Study Timeline

	Classroom A (Teacher A)	Classroom B (Teacher B)
Week 1	Chapter 1, Lesson 1 Teacher A models how to take notes and how to summarize for students	Chapter 1, Lesson 1 Teacher A conducts control lesson
Week 2	Chapter 1, Lesson 2 Students work with a partner to take notes and summarize	Chapter 1, Lesson 2 Teacher A conducts control lesson
Week 3	Chapter 1 Lesson 3 Students work independently to take notes and summarize Students take the Chapter 1 End of Chapter Test Students reflect on study strategy	Chapter 1, Lesson 3 Teacher A conducts control lesson Students take the Chapter 1 End of Chapter Test
Week 4	Chapter 3, Lesson 1 Teacher A conducts control lesson	Chapter 3, Lesson 1 Teacher A models how to take notes and how to summarize for students
Week 5	Chapter 3, Lesson 2 Teacher A conducts control lesson	Chapter 3, Lesson 2 Students work with a partner to take notes and summarize
Week 6	Chapter 3, Lesson 3 Teacher A conducts control lesson Students take the Chapter 3 End of Chapter Test	Chapter 3 Lesson 3 Students work independently to take notes and summarize Students take the Chapter 3 End of Chapter Test Students reflect on study strategy

Table 2

Dissertation Study Timeline Continued

	Classroom A (Teacher A)	Classroom B (Teacher B)
Week 7	Chapter 2, Lesson 1 Summarizing Notes homework is assigned	Chapter 2, Lesson 1 No homework assigned
	Chapter 2, Lesson 2 Summarizing Notes homework is assigned	Chapter 2, Lesson 2 No homework assigned
Week 8	Chapter 2 End of Chapter Test	Chapter 2 End of Chapter Test
Week 9	Chapter 6, Lesson 1 No homework assigned	Chapter 6, Lesson 1 Summarizing Notes homework is assigned
	Chapter 6, Lesson 2 No homework assigned	Chapter 6, Lesson 2 Summarizing Notes homework is assigned
Week 10	Chapter 6, Lesson 3 No homework assigned	Chapter 6, Lesson 3 Summarizing Notes homework is assigned
Week 11	Chapter 6 End of Chapter Test	Chapter 6 End of Chapter Test

Weeks one to three. During Week 1 of the study (Table 1), Teacher A (treatment) led the class through a reading of Chapter 1, Lesson 1 (parts of a cell). Then, Teacher A modeled a think-aloud with information that should be included in each section of the Strategic Notes template (Appendix I). During the think-aloud, the teacher shared the thinking process with the students by focusing on which information was important and the reason to include or exclude particular information. Teacher A focused on a few pages from the textbook and modeled how to select keywords and paraphrase main ideas from the first paragraph again using a think aloud. Then, using the Strategic Notes template, the teacher involved students by eliciting their

responses. Next, using the following paragraphs and through whole group instruction and discussion the teacher asked students to determine which keywords/main ideas they would select from the next paragraph and to share reasons for their selections. Teacher A paused periodically to help students determine keywords/main ideas. During the summarization demo, the teacher provided students with an oral explanation about the decision that helped to determine how to condense the information into a few clear, succinct sentences.

During Week 2 of the study, Teacher A led the class in a reading of Chapter 1, Lesson 2 (how cells make and use energy). Then, the teacher placed students in groups of two with the Strategic Notes template. Using Chapter 1, Lesson 2, each group was asked to complete the keywords/main ideas section of the Strategic Notes template. For the summary section, students worked on writing a summary together. Once the information was recorded on the template, partners were grouped with another team to share summaries and determine if important information needed to be added or removed.

During Week 3 of the study, Teacher A had students complete the Strategic Notes independently using Chapter 1, Lesson 3 (cell organization). After the reading and Summarizing Notes was completed, Teacher A had the students sketch a model of a cell, and they were taught a rap song that reviewed the functions of organelles.

During Weeks 1 to 3, Teacher B (control) led Classroom B through a reading of Chapter 1. After reading the chapter, students sketched a model of a cell, and were taught a rap song that reviewed the functions of organelles.

Weeks four to six. During Week 4 of the study, the Teacher B (treatment) led the class through a reading of Chapter 3, Lesson 1 (respiratory and circulatory system). Then, the teacher modeled a think-aloud with information that should be included in each section of the Strategic

Notes template. During the think-aloud, the teacher shared the thinking process with the students by focusing on which information was important and the reasoning to include or exclude particular information. The teacher focused on a few pages from the textbook and modeled how to select keywords and paraphrase main ideas from the first paragraph again using a think aloud. Then, using the Strategic Notes template, the teacher involved students by eliciting their responses. Next, using the following paragraphs and through whole group instruction and discussion the teacher asked students to determine which keywords/main ideas they would select from the next paragraph and to share reasons for their selections. Teacher B paused periodically to help students determine keywords/main ideas. During the summarization demo, the teacher provided students with an oral explanation about the decision that helped to determine how to condense the information into a few clear, succinct sentences.

During Week 5 of the study, Teacher B led the class in a reading of Chapter 3, Lesson 2 (digestive system). Then, the teacher placed students in pairs of two with the Strategic Notes template. Using Chapter 3, Lesson 2, each pair was asked to complete the keywords/main ideas section of the Strategic Notes template. For the summary section, students worked together to write a summary with their partner. Then, students wrote down their summaries in the summary section. Once the information was recorded on the template, partners were grouped with another team to share summaries and determine if important information needed to be added or removed.

During Week 6 of the study, Teacher B had students complete Strategic Notes independently using Chapter 3, Lesson 3 (excretory system). Then, the teacher put students into groups and assigned a body system (e.g. respiratory, circulatory, excretory) to research. Each group was responsible for finding out the main organs and functions of the system they were assigned. Next, each group was asked to create a poster of each body system in order to show

how the system worked. Then, students were assigned the task of writing an essay using the information they gathered from the research. The essay required an explanation of the functions and organs of the body system and how the body system interconnects with other systems.

During Weeks 4 to 6, Teacher A (control) led the class through a reading of Chapter 3. Students were put into groups and assigned a body system (e.g. respiratory, circulatory, excretory) to research. Each group was responsible for finding out the main organs and functions of the system they were assigned. Next, each group was asked to create a poster of each body system in order to show how the system worked, and then were asked to write an essay using the information they gathered from the research. The essay required an explanation of the functions and organs of the body system and how the body system interconnects with other systems.

Weeks seven and eight. During Week 7 and Week 8 (see Table 2), both classrooms focused on Chapter 2 (plant cells). During this chapter, both teachers completed the same in-class activities. The first activity was reading Chapter 2 as a class. Then, students created a model of a plant cell. Last, the teachers led their students through an experiment, which used food coloring and celery to show the internal structure of a plant. Students from Classroom A (treatment) were asked to complete the Summarizing Notes strategy as homework for each lesson of Chapter 2 while Classroom B (control) did not complete any homework. However, if students from Classroom B (control) decided to take notes on their own, they were asked to turn those notes in.

Weeks nine to eleven. During Week 9 to Week 11, both teachers completed the same activities. The first activity was to read the chapter together. Then, students watched a weather report. Next, students made a sketch model of the different types of breezes. Last, they learned a weather rap. The students from classroom Classroom B (treatment) were assigned the

Summarizing Notes strategy for Chapter 6 as homework. Classroom A (control) did not have homework for Chapter 6, however, if any students from Classroom A (control) decided to take notes on their own, they were asked to turn the notes in.

The idea behind this gradual release of the summarizing notes assignment was to support students in becoming a self-regulated learner.

Procedures

This study began in the Winter of 2015. One week prior to the beginning of the study, the researcher met with Teacher A and Teacher B to discuss the treatment. The researcher went over the lesson plans and timeline week by week with both teachers. The researcher also met with the students from Classroom A and Classroom B to explain the study, its purpose, and their participation. The researcher provided students with a parental consent form and the child assent form. The child assent forms were immediately collected. The parental consent forms were collected the following day.

Week 1 of the study began with students from Classroom A receiving the treatment for Chapter 1 described above, and Classroom B, the control group, used the methods that have been used in previous years for Chapter 1. The students in Classroom B did not take notes.

The treatment and control for Chapter 1 took place for three weeks. At the end of Week 3, students from both Classroom A and Classroom B took the End of Chapter Test. Students from Classroom A were asked to reflect on how the Summarizing Notes study strategy was helpful with their learning. Students were asked two questions: 1) Did this strategy help? 2) If so, how did it help? Students answered this question on a notecard and turned it into their teacher. Students in Classroom A were graded on their notes for the last lesson in Chapter 1 because this is when they completed the assignment independently.

During Weeks 4 to 6 of the study, the quasi-experimental conditions were reversed where Teacher A became the control and used the methods used in previous years, while Teacher B conducted the treatment. Students in Classroom A (control) did not take notes. Students from both classrooms completed the End of Chapter Test for Chapter 3 during Week 6. Students from Classroom B (treatment) were asked to reflect on how the Summarizing Notes study strategy was helpful with their learning. Students were asked two questions: 1) Did this strategy help? 2) If so, how did it help? Students answered this question on a notecard and turned it into their teacher. Students in Classroom B were graded on their notes for the last lesson in Chapter 3 because this is when they completed the assignment independently.

During Week 7 and Week 8, both classrooms focused on Chapter 2 (plant cells). During this chapter, both teachers completed the same in class activities. Students from Classroom A (treatment) was asked to complete the Summarizing Notes strategy as homework for each lesson of Chapter 2 and were graded on this assignment. These were collected by the teacher, and then graded by the researcher, while Classroom B (control) did complete any homework. However, if students from Classroom B (control) decided to take notes on their own, they were asked to turn those notes in.

During Week 9 to Week 11, both classrooms focused on Chapter 6 (weather). During this chapter, both teachers completed the same activities. The students from Classroom B (treatment) were assigned the Summarizing Notes strategy for Chapter 6 as homework and were graded on this assignment. The homework was collected by the teacher and graded by the researcher. Classroom A (control) did not have homework for Chapter 6, however, if any students from Classroom A (control) decided to take notes on their own, they were asked to turn the notes in.

In the case of absences, Make-up End of Chapter Tests were administered prior to any instruction in the subsequent content area. It is also important to note that the science chapters were taught out of numerical order.

Duration. The study lasted approximately eleven weeks during the Winter of the 2015-2016 school year. During Weeks 1 to 3, instruction began and culminated with an End of Chapter Test. During Weeks 4 to 6, instruction will begin immediately followed by an End of Chapter Test in Week 6. During Weeks 7 and 8, Classroom A was assigned the Summarizing Notes as homework. During Weeks 9 through 11, Classroom B was assigned the Summarizing Notes as homework.

Data Analysis

To address the first research question, quantitative analysis included descriptive and inferential statistics. Means and standard deviations were collected for Summarizing Notes and student test scores. Between groups and within groups t-tests were calculated to examine the mean differences between Classroom A and Classroom B.

To address the second research question, quantitative analysis included descriptive and inferential statistics. Means and standard deviations were collected for Summarizing Notes and student test scores for low achievers. Between groups and within groups t-tests were calculated to examine the mean differences.

To address the third research question, descriptive statistics included the means for Summarizing Notes. Means were calculated to examine the percentage of students who scored needs improvement, making progress, proficient, or advanced.

To address the fourth research question, quantitative analysis included inferential statistics. Scores for Summarizing Notes and End of Chapter Test scores were used to calculate

Pearson r correlations. This was used to examine the relationship between the Summarizing Notes performance category and End of Chapter test scores.

To address the fifth research question, students' perceptions of the summarizing study strategy was collected and examined using qualitative analysis. The researcher read through student perceptions in order to find common categories or themes.

Limitations

One of the main limitations to this study was the convenience sample. The sample was readily available and easily accessible to the researcher. This could be a potential problem because it does not allow the researcher to adequately control the demographic characteristics within the sample. Therefore, although the results of this study may be informative, it is not clear how broadly these findings might apply to other fifth grade classrooms. A method of rectifying this problem could be to implement this strategy in other schools with different students of different ethnicities and socio-economic statuses.

A second factor that may be a limit to the effectiveness of the study was the length of the intervention. Most research suggests that to perform an effective learning intervention, duration of the intervention should last a minimum length of four weeks. Although the study lasted eleven weeks, the actual intervention only lasted for approximately two hours a week totaling eleven hours. Therefore, the researcher's goal in applying a Self-regulation study strategy for a short period of time may not be effective.

The last limitation is a possible carry over effect. Students in the control group during the second phase of the study may use the Self-regulated study strategy of Summarizing Notes to study for the next chapter's test even though not explicitly instructed to. Similarly, students who have been taught how to prepare for a test prior to this study may use means other than the

Summarizing Notes strategy taught here to get ready for the End of Chapter Tests. Typically, students who are taught study strategies are often motivated to obtain good grades; therefore, will put in more effort into preparing for a test, although a within group analysis of research question two will help unravel this issue.

Table 3

Research Questions, Data, Variables, and Data Analysis

Research Questions	Data Source	Variables	Data Analysis
What are the effects of Summarizing Notes on students' End of Chapter science test scores?	End of Chapter Test	Test scores	Between groups t-test Within groups t-test
What are the effects of Summarizing Notes on low achievers' End of Chapter science test scores?	Current science grade (69 percent or below is low achieving) Student summary of notes	Summary score	Between groups t-test Within groups t-test
What percentage of students scored needs improvement, making progress, proficient, or advanced when Summarizing Notes?	Student summary of notes	Summary score	Descriptive statistics
Do the Summarizing Notes performance scores relate to End of Chapter science scores?	Student summary of notes End of Chapter Test	Summary score End of Chapter Test scores	Pearson r correlation
What are students' perceptions of the Summarizing Notes activity?	Student description of how summarizing notes supported studying	Self-regulation	Qualitative analysis

CHAPTER IV: RESULTS

The purpose of this study was to explore whether the self-regulation study strategy, Summarizing Notes, could improve fifth grade science achievement, particularly for underperforming students. At the beginning of the study, students were assigned into different achievement levels (low, middle, or high) according to current science grades. These grades were based on previous tests and assignments given to them by their teacher. Students were taught the Summarizing Notes strategy, and then took End of Chapter Tests. Then, the mean differences between science test scores when using and not using the Summarizing Notes strategy were examined. Next, a correlational analysis between Summarizing Notes performance scores and End of Chapter science test scores was evaluated. Last, student opinions, about the Summarizing Notes study strategy, were collected and qualitatively examined.

The main variables studied were End of Chapter science test scores (reported in standard scores), as well as student homework. Student homework consisted of notes that consisted of a summary, a task assigned by their teachers, using readings from chapters in the district mandated science textbook, California Science (Houghton Mifflin, 2007).

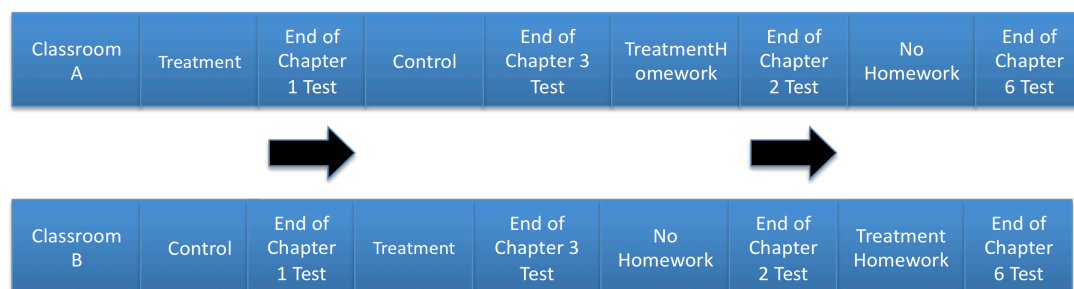


Figure 3. This figure illustrates a crossover repeated measures design.

The research design consisted of a crossover repeated measures design (Figure 3; provide citation for the design). This design was used to ensure that both classrooms received instruction in Summarizing Notes and could act as both treatment and control groups. To assess the quality

of students' adoption of the Summarizing Notes study strategy, student work was analyzed using a four-point rubric based on how well they did when they summarized their notes (see Appendix G). Students were given between one to four points based on how well they implemented the Summarizing Notes strategy, and consisted of the following categories: 1) needs improvement, 2) making progress, 3) proficient, or 4) advanced. In addition, students were asked for their opinions on the Summarizing Notes study strategy; specifically, students were asked to reflect upon the strategy by explaining how it was supportive.

For this study the following research questions were considered:

Research Question 1: What are the effects of Summarizing Notes on students' End of Chapter science test scores?

Research Question 2: What are the effects of Summarizing Notes on low achievers' End of Chapter science test scores?

Research Question 3: What percentage of students scored 1 "needs improvement", 2 "making progress", 3 "proficient", or 4 "advanced" when Summarizing Notes?

Research Question 4: Do the Summarizing Notes performance category scores (i.e., 1-4) correlate to End of Chapter Test scores?

Research Question 5: What were students' perceptions of the Summarizing Notes strategy?

The next step in the analysis was to evaluate the classrooms to see if they were equivalent in terms of science scores, summarizing notes performance, and achievement categories (i.e., science grades). This preliminary analysis showed there were no differences between classrooms.

Preliminary Analyses

To establish that the classrooms, chapters, and summarizing notes conditions were the same, preliminary analyses were conducted. An independent sample test was used to explore differences in science achievement by chapter. Results indicated that there was no difference in achievement by chapter ($M = 1.44$, $p = .42$). An independent sample test was used to explore the differences in science achievement by classroom. Results indicated that there was no significant difference in achievement by classroom ($M = .73$, $p = .82$). In each classroom there were the following percentages of student achievement categories, 10% low, 20% middle, and 22% high for Classroom A. Classroom B had 6% low, 14% middle, and 18% high. A chi square test indicated that there were no differences in student performance categories between the two classrooms, $\chi^2(2, N = 90) = 0.29$, $p = .87$.

Research Question 1: What are the effects of Summarizing Notes on students' End of Chapter science test scores? To understand the effects of summarizing notes, two independent t-tests and two dependent t-tests were conducted. An independent t-test was used to compare the means of science test scores between classrooms. Results indicated there was no statistically significant difference in scores for Classroom A ($M = 72\%$, $SD = 3\%$) and Classroom B ($M = 76\%$, $SD = 3\%$) when Classroom A was given the treatment condition; $t(41) = 0.90$, $p = .37$. Results also indicated there was no difference in scores between Classroom B ($M = 69\%$, $SD = 4\%$) and Classroom A ($M = 75\%$, $SD = 3\%$) when Classroom B was given the treatment condition; $t(39) = 1.24$, $p = .22$.

A dependent t-test was used to compare mean scores between the treatment and control chapters within each classroom. This examined whether or not the Summarizing Notes treatment improved science achievement when students engaged in the treatment. Results indicated there

was not a significant effect for either classroom: Classroom A ($M = -2\%$, $SD = 2\%$); $t(22) = -0.96$, $p = .35$. and Classroom B when they received the treatment relative to the control ($M = 6\%$, $SD = 3\%$); $t(16) = 2$, $p = .06$.

Research Question 2: What are the effects of Summarizing Notes on low achievers'

End of Chapter science test scores? To understand the effects of summarizing notes on low achievers' science test scores a Mann-Whitney Test was conducted to examine the difference between low achievers' ($n=3$) test scores between classrooms. Results indicated there was no statistically significant difference in scores when Classroom A was given the treatment condition; $z = 0.00$, $p = 1.0$. However, results indicated there was a small statistically significant difference in scores when Classroom B was given the treatment condition; $z = 1.99$, $p = 0.04$.

A Wilcoxon Signed-Rank Test was conducted to examine whether or not the Summarizing Notes treatment improved science achievement for low achievers ($n=3$) within classrooms. Results indicated there was no difference for Classroom A when given the treatment condition; $z = -1.06$, $p = 0.29$ and there was no mean difference for low achievers in Classroom B when given the treatment condition; $z = 1.60$, $p = 0.11$.

Research Question 3: What percentage of students scored needs improvement, making progress, proficient, or advanced when Summarizing Notes? Summarizing Notes scores were calculated by taking the average of the scores from the two treatments. In Classroom A, 14% scored needs improvement, 25% scored making progress, 14% scored proficient, and seven percent scored advanced. In Classroom B, 30% scored needs improvement, 34% scored making progress, 23% scored proficient, and 11% scored advanced. An independent t-test was conducted to examine the mean difference between classrooms for Summarizing Notes. Results

indicated there was no mean difference between Summarizing Notes scores ($M = 2.3$, $SD = .15$); $t(42) = 0.46$, $p = .65$.

Research Question 4: Do the Summarizing Notes performance scores correlate to End of Chapter Test scores? A Pearson correlation was used to examine whether there was an association between how well students performed on Summarizing Notes and their performance on the science tests. Results indicated a weak but positive correlation $r(44) = .35$, $p = .02$.

Research Question 5: What are students' perceptions of the Summarizing Notes activity? To address the fifth research question, students' perceptions of the Summarizing Notes study strategy was collected and examined using qualitative analysis. The researcher read through student perceptions in order to find common categories or themes (Creswall, 2013).

During this portion of the study, students were asked to write down whether they felt the strategy was helpful and how was it helpful. Many students were able to answer the first question, but many had difficulty answering how it helped. Most students were not able to express how it helped because they did not answer the question. However, for those that were able to express their perceptions, these four themes were found: organization, memory, simple, or not helpful.

Students perceived the organization of the notes to be most beneficial. The notes were organized into three sections: key words, main ideas, and summary. They felt that this way of organizing the notes made it easier to understand the main ideas of the chapter. They believed that the organization made the information easily accessible during classroom activities. For example, one student said, "It did help me because it was easier to take notes. It kinda keeps notes more organized."

Additionally, students felt that the Summarizing Notes study strategy made the information simpler to understand. Another students stated, “It prevented me from making notes too long.” Moreover, students felt that Summarizing Notes helped with memory. One student said, “It helped me burn images of facts into my mind helped me remember them.” Moreover, students believed by using this strategy they were able to retain the important details and vocabulary better than before. However, there were a few students who perceived Summarizing Notes to not be helpful at all. These students perceived the Summarizing Notes to be redundant. Some felt that having to write notes and then rewrite the information again was not conducive to learning. For example, a student stated, “The summary didn’t help because what I wrote in my summary was already in my main points.” It seemed that students did not understand that redundancy was beneficial to learning.

Overall, the most common theme was organization. Students seemed to feel that organization and the ability to find information quickly when working on assignments was conducive to learning. Tables 6 provides several quotations with student answers.

Table 4

Themes Found About the Helpfulness of Summarizing Notes

Question	Themes	Sample Student Responses
How did summarizing your notes help you?	Organization	<p>"It helped me because it had a lot of good info and it was very organized."</p> <p>"It did help me because it was easier to take notes. It kinda keeps notes more organized."</p> <p>"Underlining and summarizing the important data helped me find what I needed."</p> <p>"The one thing that did help me was the dividing lines so things weren't jumbled up like they used to be."</p> <p>"The strategy helped me because I could find the answers quicker."</p> <p>"It helped me because I learned how to organize my notes."</p> <p>"It made it simpler and easier to understand."</p> <p>"It prevented me from making notes too long."</p>
	Simple, or Simpler to Understand	

Table 4 continued
Themes Found About the Helpfulness of Summarizing Notes Continued

Question	Themes	Sample Student Responses
How did summarizing your notes help you?	Memory	<p>"It helped me to memorize what the vocab is."</p> <p>"It helped me by memorizing the facts instead of looking at every sentence in the book which takes forever."</p> <p>"It helps me remember the stuff about science."</p> <p>"It helped me burn images of facts into my mind helped me remember them."</p>
	Not Helpful	<p>"Not very much, to me its just answers on paper except its not cheating."</p> <p>"The summary didn't help because what I wrote in my summary was already in my main points."</p> <p>"It didn't help at all because it was just a review that told what I learned. It isn't really helpful."</p>

Missing Data

Over the course of the study, there were factors that resulted in missing data. In relation to the Summarizing Notes homework assignment, some students chose not to complete the task. In regards to the End of Chapter tests, there were a few students who were absent for an extended period of time due to family vacations; therefore, these students did not have tests scores.

Summary

To sum up, when comparing classrooms there was no statistical significance between scores when given the treatment, but there was a small statistical significance when comparing within group mean differences. In other words, students did better from one chapter to the next chapter when given the treatment condition. Last, there was correlation between how well students performed on Summarizing Notes and their performance on the science tests. Results indicated a weak but positive correlation.

CHAPTER V: DISCUSSION

Summary of Study

The purpose of this study was to examine the effects on student learning when taught how to Summarize Notes while studying core curriculum science text.

Summarizing Notes was expected to positively affect science achievement tests, and that the strategy would show greater increments of learning in low achieving students. There was also an expectation that students would perceive this self-regulation (SR) study strategy to be supportive towards learning.

Student performance on international education assessments reveal the lack of growth in scientific fields; less than 10 percent of 15 year-old students are performing proficiently according to the Program for International Student Assessment (PISA) (Daugherty, 2013). Consequently, there is a lack of growth of United States professionals who are becoming specialists in the sciences compared to other countries. Although occupations in this field are expected to grow, there are not enough students graduating with science degrees (U.S. Department of Commerce, 2009).

A variety of reasons have contributed to this decline in students graduating with a science degree, but according to recent literature, one explanation is that students are not being educated on how to use Self-regulation (SR) study strategies (Crede & Kuncel, 2008; Moely et al., 1992; Rachal, Daigle, & Rachal, 2007). Self-regulation is when a learner can monitor and reflect on his or her learning behavior; however, it is thought that a lack of acquiring SR study strategies at the elementary level is resulting in long-term negative effects on academic success (Nonis & Hudson, 2010).

Research shows that during elementary years students are becoming more aware of learning processes, however, the teaching of effective SR study strategies within the elementary core curriculum is needed (Moely et al., 1992). A lack of teaching (SR) study strategies at the elementary stage sets the precedent of underperforming high school and college students. Elementary school is where students learn how to create study habits, therefore, this is the setting that should be used to instill SR study strategies (Son, 2005). The lack of emphasis on teaching study strategies at the elementary level will most likely have a negative effect on student achievement as they move on into the later years of their education.

Results from recent research on SR strategies imply that low-achieving college students use inefficient SR study strategies (Ruban & Reis, 2006). Self-regulation study strategies have been studied extensively at the college level and to some degree at the high school level. Recent research has informed us that successful high school and college students employ SR study strategies, therefore, teaching young students such strategies would enhance performance in elementary school and will prepare them for future educational success.

The present study examined the effect of teaching students how to actively participate in their learning through the use of a key SR study strategy—Summarizing Notes. Research in science and literacy education suggests that students benefit most when they actively participate in their learning (Zimmerman, 2002). The effects of not having learned SR study strategies at an early age may lead to problems in academic performance especially at the college level.

The purpose of this study was to explore whether using a SR study strategy, Summarizing Notes, could improve fifth grade science achievement, especially for underperforming students. There were five research questions considered:

Research Question 1: What are the effects of Summarizing Notes on students' End of Chapter science test scores?

Research Question 2: What are the effects of Summarizing Notes on low achievers' End of Chapter science test scores?

Research Question 3: What percentage of students scored needs improvement, making progress, proficient, or advanced when Summarizing Notes?

Research Question 4: Do the Summarizing Notes performance scores correlate to End of Chapter Test scores?

Research Question 5: What were students' perceptions of the Summarizing Notes activity?

The data in this study come from two fifth grade classrooms in a suburban elementary school of Northern California. This was a convenience sample and students represented a broad range of achievement levels, ethnic, and socioeconomic backgrounds.

This study consisted of four stages. During the first stage, Classroom A was given the Summarizing Notes treatment, while Classroom B did not. During the second stage, Classroom B implemented the Summarizing Notes treatment, while Classroom A did not. The third stage consisted of assigning students from Classroom A the Summarizing Notes as homework, while students from Classroom B were not assigned homework. The fourth

and final stage, students from Classroom B were assigned Summarizing Notes as homework, while students from Classroom A were not assigned any homework.

The variables examined in this study were Science Achievement, Summarization of Notes, and perceived usefulness of the Self-regulation study strategy.

Science Achievement was measured by four End of Chapter Tests by California Science (Houghton Mifflin, 2007) mandated by the school district. All tests scores were entered as a percent correct. The End of Chapter Test for Chapter 1 (cells) consisted of 10 vocabulary questions followed by 10 short answer questions. Similarly, the End of Chapter Test for Chapter 3 (body systems) contained ten vocabulary questions, however, it only consisted of seven short answer questions and three multiple-choice questions. The End of Chapter Test for Chapter 2 (plant cells) included one question, which required students to interpret data from a table. There were two true/false vocabulary questions, two short answer vocabulary questions, and ten short answer questions. The End of Chapter Test for Chapter 6 (weather) included 10 fill in the blank vocabulary questions, four multiple-choice questions, and six short answer questions.

The SR study strategy Summarizing Notes was assessed by collecting student work and using a scoring rubric (Appendix G) to analyze the quality of students' adoption of the SR study strategy (cite). Students Summarized Notes based on readings from the district mandated science textbooks. Each chapter was similar in structure in that each chapter consisted of vocabulary word definitions and two to three lessons. To support comprehension, each chapter provided labeled diagrams, tables, and pictures. Every lesson began with a main idea sentence and ended with a summary.

Student discussed their perceptions about the SR study strategy through written comments. Students were asked whether the strategy was helpful, and if so, how was it helpful. Students were asked this after each treatment. The researcher collected the written comments and coded answers into categories.

Summary of Findings

This section outlines the summary of findings for the study. Findings will be discussed by each research question. Within each research question discussion, quantitative results will be discussed.

Research Question 1: What are the effects of Summarizing Notes on students' End of Chapter Science Tests?

When comparing the two classrooms, the analysis shows that there was no difference between scores when Classroom A was given the treatment condition (i.e., summarizing notes), and there was no difference in scores when Classroom B was given the treatment condition. When comparing within group scores across chapters, scores indicated that summarizing notes did not have an effect on test scores for students in Classroom A or Classroom B.

Research Question 2: What are the effects of Summarizing Notes on low achievers' End of Chapter science test scores?

A test was conducted to examine the difference between low achievers' test scores between classrooms. Results indicated there was no mean difference in scores when Classroom A was given the treatment condition, but results did indicate there was a

small statistical significance in scores for when Classroom B was given the treatment condition.

A within groups Wilcoxon Signed-Rank Test was conducted to examine whether or not the Summarizing Notes treatment improved science achievement for low achievers within the chapters. Results indicated that there was no effect on low achieving students' test scores in Classroom A or Classroom B.

Research Question 3: What percentage of students scored 1) needs improvement, 2) making progress, 3) proficient, or 4) advanced when Summarizing Notes?

Summarizing Notes scores were calculated by taking the average of the scores from the two treatments for each class. Results indicated there was no mean difference between classroom when summarizing notes.

Research Question 4: Do the Summarizing Notes performance scores relate to End of Chapter science test scores?

A Pearson correlation was used to examine whether there was an association between how well students performed on Summarizing Notes and their performance on the science tests. Results indicated a weak but positive correlation.

Research Question 5: What are students' perceptions of the Summarizing Notes activity?

classroom a. The fifth research question addresses student perception of the Summarizing Notes treatment. This data was collected through student written statements. There were three major themes found. The first theme is Organization.

Students felt that the format used to Summarize Notes provided them with a technique that made it clear, and easy to read, study, and find information. The second theme found was Simplicity. Students felt that the format made things easier to understand. It allowed them to really extract the most important information from the readings. The last major theme was Not Helpful. Some students felt that Summarizing Notes did not support learning. They felt that writing a summary was redundant since they had already written the main points.

classroom b. Classroom B had similar themes to Classroom A: Simplicity and Organization. Students felt that the this format helped them to organize their thinking, and that it made understanding the content simpler. However, where they differed was in the theme of Memory. Students in Classroom B felt that Summarizing Notes helped them to remember vocabulary and important facts about the content they were studying. Overall, most students thought Summarizing Notes was a supportive study strategy.

Limitations

One of the main limitations to this study was the convenience sample. Students are assigned randomly to classrooms at the beginning of the school year, but it is the school's practice to use teacher's evaluations to create what would be considered leveled classrooms. This is a problem because it did not allow the researcher to adequately control the characteristics of each sample. Therefore, although the results of this study may be informative, it is not clear how broadly these findings might apply to other fifth grade classrooms. A method of rectifying this problem could be to implement this

strategy in other schools with different students of different ethnicities and socio-economic statuses.

A second factor that may have been a limit to the effectiveness of the study was the length of the intervention. Most research suggests to perform an effective learning intervention that will last at least four weeks. Although the study lasted for three and a half months, the actual intervention only lasted approximately two hours a week. Therefore, the researcher's goal in applying a Self-regulation study strategy for a short period of time may not have been effective.

A third limitation to this study was the pacing of the lessons. In the past, the teachers who participated in this study would spend more time on each lesson regardless of the district's pacing guide. Teachers would either speed up or slow down lessons based on how students are doing with different topics; however, due to the study's protocol teachers felt the pacing was faster than in previous years, which may have had an effect on student understanding.

One research question in this study examined the relationship between how well students Summarized Notes and End of Chapter Test performance. Overall, statistical significance was not met; however, this may be due to the short amount of time given for each lesson. In fact, at one point in the study the students had asked one teacher to slow down the pacing of each lesson because they were going through the readings relatively quickly. This may have impacted the tests scores. It is possible that students needed more time to absorb the information, and they most likely needed more mental modeling. According to previous literature, students need more time watching teachers model, and

they need more time to practice (Ness, 2011). Teaching requires a lot of mental modeling, which can be a challenging process for teachers without enough time (Ness, 2011).

The last limitation is students' comprehension levels. In order for students to take accurate notes and synthesize the information to form a summary, the researchers assume that all of the students have the capability to do so. However, classrooms are created based on teacher evaluation of low, medium, and high, which means students in the low group would need more support understanding the text. These students would have more difficulty with taking notes because of their low reading skills.

Discussion of Findings

This study aimed to assess the effect of a SR strategy, Summarizing Notes, on student science performance. Although statistical significance was not met between group scores, there was an increase in mean scores within groups. There was also a weak, but positive correlation between Summarizing Notes and science test scores, which is very promising.

The present findings are consistent with previous research in that summarizing has been acknowledged as one of the most effective comprehension strategies that produces long-term retention (Sporer, Brunstein, & Kieschke, 2009; Westby et al., 2010). Based on the percentage of students that scored Proficient and Advanced on the Summarizing Notes study strategy, the increase in mean End of Chapter Test scores signified student learning. This strategy provided students with an opportunity to link the

information to either previous knowledge or new knowledge; therefore, learning skills that promoted independent learning.

This present study is also consistent with findings by Boekaerts and Cascallar (2006) in that students need to know what strategies are needed to guide and direct their own learning process. As students progress from the elementary grades to college, they will be asked to study textbooks prior to attending class, and teachers will assume that students know which strategies to use in order to comprehend non-fiction texts independently. This is when Self-regulation study strategies such as Summarizing Notes is needed. The Summarizing Notes strategy provides a skill that can be used autonomously.

This study not only describes an effective study strategy, but it also provided students with opportunities to practice comprehension using non-fiction texts. Summarizing is considered effective because students are simultaneously extracting and constructing information through the interaction of written language. Reading non-fiction texts is very difficult for some students especially science texts because they tend to be filled with technical terms and content that cannot easily be visualized (Westby et al, 2010). Some students at the elementary level have problems understanding expository texts because they often do not have the background knowledge needed to recognize the gist of the text and to build mental representations. Expository (non-fiction) texts have very difficult vocabulary and syntactic patterns (Westby et al., 2010). When students encounter difficult information, it is easier to ignore because they cannot make the connections to previous learned knowledge. Summarizing Notes gives students support in

tackling such difficult text. Since many students in this study were able to Summarize Notes, the findings corroborate with previous literature (Brown and Day, 1983; Westby et al, 2010), which inferred that fifth graders can be taught how to summarize effectively. This enables some students to better comprehend non-fiction texts, which are usually deemed difficult to read at the elementary level (Ness, 2011).

Recent research reports that teachers are not spending enough time implementing reading comprehension strategies in the elementary classroom and nearly nine million of today's fourth through twelfth graders struggle with reading (Ness, 2011). Using an SR study strategy such as Summarizing Notes with the content area of science, provides students with more opportunity to practice reading comprehension with difficult text. Additionally, when teachers use the Summarizing Notes study strategy during class, the time spent is time spent efficiently because of the integration of reading comprehension and content area instruction.

In addition, this study provides empirical support for implementing summarization at the early stages of elementary school, an area previously under researched. The majority of studies focus on middle school or higher, but this present study acknowledges that elementary students can be taught such strategies (Ruban & Reis, 2006). Recent research concluded that students were beginning college without basic foundational study skills. Moreover, Ruban and Reis (2006) found that low-achieving college students have inefficient study skills. They tend to use strategies that are superficial, which does not lend itself to formulate knowledge, while high-achieving students tend to organize and condense notes, which forces a formulation of knowledge

thereby processing information in a deep manner (Ruban & Reis, 2006). Therefore, Summarizing Notes is a strategy that should be taught at the younger grades in order for students to master the ability to formulate knowledge, independently, prior to entering middle school and beyond.

The last research question in this study addressed Self-regulation. Students were asked about their perception of how the Summarizing Notes study strategy supported learning. The findings support previous literature, which claims that reorganizing information is a learning strategy (Zimmerman & Martinez Pons, 1998). Students in both classrooms felt that the Summarizing Notes study strategy was helpful because it provided a process for the organization and retention of information. Therefore, teaching such strategies at an early age promotes the necessary skills in becoming an independent, lifelong learner. Although teaching students this Self-regulation strategy did not result in statistically significant differences at the elementary level, one can argue that it takes time to learn Self-regulation strategies and only with time and practice can they fully be developed (Ramdass & Zimmerman, 2011). This corroborates with finding from previous literature in that older students are having to take study skills courses during their first year of college because they are not receiving the necessary SR study strategies at an early age (Crede & Kuncel, 2008; Mireles, et al., 2011). If students are taught Self-regulation strategies at an early age, by the time they reach the collegiate level, such strategies will have already been developed; therefore, they can focus on learning instead of learning how to learn.

Self-regulation skills are needed because these are the types of skills young adults will need as they enter the workforce (Zimmerman, 2002). As young adults began working in a professional setting, they will be expected to know how to observe and become proficient on their own, and if educators do not teach such strategies at an early age, Self-regulation may not develop as is necessary (Zimmerman, 2002). The reason this study is so pertinent to the educational field is that it describes how teachers can provide opportunities for students to increase Self-regulation, which affords students with the skills needed to be lifelong learners (Zimmerman, 2002).

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Appendixes

Appendix A
IRBHPS Approval Letter

Christy Lusareta <noreply@axiommentor.com>
 To: mmendoza@usfca.edu
 Reply-To: Christy Lusareta <calusareta@usfca.edu>
 Amendment Approved - Exempt Protocol - IRB ID: 380

September 24, 2015 7:54 AM



Amendment Approved

To: Michelle Mendoza Nebres
 From: Terence Patterson, IRB Chair
 Subject: Protocol #380
 Date: 09/24/2015

Dear Michelle Mendoza Nebres:

Your Amendment for research (IRB Protocol #380) with the project title **IRB Application for Exempt Research** has been approved by the IRB Chair on **09/24/2015**.

Any modifications, adverse reactions or complications must be reported using a modification application to the IRBPHS within ten (10) working days.

If you have any questions, please contact the IRBPHS via email at IRBPHS@usfca.edu. Please include the Protocol number assigned to your application in your correspondence.

On behalf of the IRBPHS committee, I wish you much success in your research.

Sincerely,

Terence Patterson, EdD, ABPP
 Professor & Chair, Institutional Review Board for the Protection of Human Subjects
 University of San Francisco
 irbphs@usfca.edu
<https://www.axiommentor.com/pages/home.cfm>

Christy Lusareta <noreply@axiommentor.com>
 To: mmendoza@usfca.edu
 Exemption Notification - IRB ID: 380

February 3, 2015 11:28 AM



Protocol Exemption Notification

To: Michelle Mendoza Nebres
 From: Terence Patterson, IRB Chair
 Subject: Protocol #380
 Date: 02/03/2015

The Institutional Review Board for the Protection of Human Subjects (IRBPHS) at the University of San Francisco (USF) has reviewed your request for human subjects approval regarding your study.

Your project (IRB Protocol #380) with the title **IRB Application for Exempt Research** has been approved by the University of San Francisco IRBPHS as Exempt according to 45CFR46.101(b). Your application for exemption has been verified because your project involves minimal risk to subjects as reviewed by the IRB on 02/03/2015.

Please note that changes to your protocol may affect its exempt status. Please submit a modification application within ten working days, indicating any changes to your research. Please include the Protocol number assigned to your application in your correspondence.

On behalf of the IRBPHS committee, I wish you much success in your endeavors.

Sincerely,

Terence Patterson,
 Chair, Institutional Review Board for the Protection of Human Subjects
 IRBPHS - University of San Francisco
 IRBPHS@usfca.edu

Appendix B
Letter of Permission from the Superintendent



**FREMONT
UNIFIED SCHOOL
DISTRICT**

BOARD OF EDUCATION

Lara Calvert-York
Debbie Campbell
Ann Crosby
Lily Mei
Larry Sweeney

James Morris, Ed.D.
Superintendent
(510) 659-2542

Raul A. Parungao
Associate Superintendent
(510) 659-2572

Kim Wallace, Ed.D.
*Assistant Superintendent,
Instruction*
(510) 659-2583

Raúl M. Zamora, Ed.D.
*Assistant Superintendent,
Human Resources*
(510) 659-2556

4210 Technology Drive
P.O. Box 5008
Fremont, California
94537-5008
(510) 657-2350

<http://www.fremont.k12.ca.us>

Michelle Nebres
Maloney Elementary School
38700 Logan Drive
Fremont, CA 94536

February 4, 2015

Dear Ms. Nebres,

I am pleased to inform you that the proposed research study, *Does Training in Summarizing Notes Increase Fifth Grade Student Science Achievement?*, is approved for implementation in the Fremont Unified School District.

You may proceed to collect and compile data and elicit volunteer participants. Because students will be involved in the study, it is important that you ensure that the parent of each participant completes an informed consent form and that you keep copies of all required documents.

Upon completion of the study, you are required to provide this office with a copy of the final dissertation. I look forward to reading your study and wish you continued success.

Sincerely,

James Morris

C: Mr. Wood, Principal, Maloney Elementary



**FREMONT UNIFIED
SCHOOL DISTRICT**

4210 Technology Drive
P.O. Box 6008
Fremont, CA 94537
(510) 657-2360
www.fremont.k12.ca.us

Michelle Nebres
Maloney Elementary School
38700 Logan Drive
Fremont, CA 94536

September 30, 2015

Dear Ms. Nebres,

I am pleased to inform you that the proposed revised research study, *Does Training in Summarizing Notes Increase Fifth Grade Student Science Achievement?*, is approved for implementation in the Fremont Unified School District.

You may proceed to collect and compile data and elicit volunteer participants. Because students will be involved in the study, it is important that you ensure that the parent of each participant completes an informed consent form and that you keep copies of all required documents.

Upon completion of the study, you are required to provide this office with a copy of the final dissertation. I look forward to reading your study and wish you continued success.

Sincerely,

James Morris

c: Mr. Wood, Principal, Maloney Elementary

Board of Education
Desrie Campbell
Ann Crosbie
Larry Sweeney
Yang Shao, Ph.D.
Michela Berke, Ph.D.

Superintendent
James Morris, Ed.D.
(510) 659-2642

Associate Superintendent
Raul A. Parungao
(510) 659-2572

Assistant Superintendent, Instruction
Kim Wallace, Ed.D.
(510) 659-2683

Assistant Superintendent, Human Resources
Raúl M. Zamora, Ed.D.
(510) 659-2556

Appendix C
Letter of Permission from the Principal



FREMONT
UNIFIED SCHOOL
DISTRICT

BOARD OF EDUCATION

Desrie Campbell
Ann Crosbie
Larry Sweeney
Yang Shao, Ph.D.

James Morris, Ed.D.
Superintendent
(510) 659-2542

Raul A. Parungao
Associate Superintendent
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Kim Wallace, Ed.D.
*Assistant Superintendent,
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*Assistant Superintendent,
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P.O. Box 5008
Fremont, California
94537-5008
(510) 657-2350

<http://www.fremont.k12.ca.us>

January 27, 2015

Dear Dr. Morris

I am writing you to give my informed approval of the doctoral research project presented to me by Michelle Mendoza-Nebres, a fourth grade teacher currently working at Maloney Elementary. She has presented a completed proposal highlighting the research question to determine if summarization of science classroom notes will increase learning outcomes for our fifth grade students in the area of science.

Please feel free to contact me with any questions or concerns.

Sincerely,

Christopher M. Wood
Principal
Tom Maloney Elementary School
(510) 797 4426 x64102



FREMONT UNIFIED
SCHOOL DISTRICT

4210 Technology Drive
P.O. Box 5008
Fremont, CA 94538
(510) 657-2350
www.fremont.k12.ca.us

Michelle Nebres
Tom Maloney Elementary School
38700 Logan Drive
Fremont, CA 94536

September 30, 2015

Dear Ms. Nebres,

It is my pleasure to approve your proposed revised research project entitled, *Does Training in Summarizing Notes Increase Fifth Grade Student Science Achievement?*, for implementation in the Fremont Unified School District.

Please be sure to complete all required district forms, and follow district policies as your research moves forward with collecting data, and working with students. It is also important to receive consent from each student's parent before the research project can proceed.

Please let me know of any support you may need as your project progresses, and I look forward to discussing your findings with you.

Sincerely,

Christopher M. Wood
Principal
Tom Maloney Elementary School

Board of Education
Desrie Campbell
Ann Crosbie
Larry Sweeney
Yang Shao, Ph.D.
Michele Berke, Ph.D.

Superintendent
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Appendix D
Written Letter Requesting for Parental Consent



Dear Parents,

My name is Michelle Nebres, and I am a doctoral candidate in the School of Education at the University of San Francisco. I am sending this letter to ask for permission to use your child's classroom science assessment data in my dissertation study titled ***Summarizing notes: effects of teaching students a self-regulation study strategy in science learning***. I am examining a self-regulation study strategy and would like to see whether learning a particular study strategy will affect science learning.

The study will be conducted during normal school hours in your child's classroom. There are no known risks involved. To protect your child's confidentiality, your child's name will not appear on any record sheets. The information obtained will not be shared with anyone, unless required by law. I will maintain the records with the support of my faculty advisor, Dr. Nicola McClung. If you have any questions, please contact me via email at mmendozanebres@fremont.k12.ca.us or you can visit me in my classroom (room P4) after school hours to discuss any questions you have.

This letter will serve as a consent form to use your child's data. If you have any questions about your child's rights as a participant, you may contact the University of San Francisco International Review Board for the Protection of Human Services at 415-422-5555 ext. 6091 or via email IRBPHS@usfca.edu.

If you are interested in receiving a summary of the aggregated data, please check the box on the back of this letter indicating you would like a copy of the results.

Sincerely,

Michelle Nebres

Statement of Consent

I read the consent form for the dissertation study titled *Training in summarizing notes: effects of teaching students a self-regulation study strategy in science learning* conducted by Michelle Nebres of the University of San Francisco. The nature, demands, and risk of the study have been explained to me. I am aware that I have the opportunity to ask questions about this research. I understand that I may withdraw my consent to use my child's data at any time without penalty.

Child's Name (print clearly)

Signature of Legal Guardian

Date

☐

Please check this box if you would like a summary of the aggregated data.

Appendix E
Teacher Lesson Plans

Class: Classroom A/Teacher A

Course: Science Chapter 1

Materials: Houghton-Mifflin Science Textbook Grade 5, Strategic Notes template, poster paper, markers, binder and plain paper, pencils,

- I. Class Objectives:** Student will summarize notes, make a sketch of cells, and learn a cell function rap song
- II. Anticipatory Set:** Ask students, “How do you study for a test?” Have some students talk about the ways they study. Tell them they will learn a new way to study for a test.
- III. Introduction:** Tell students they will learn to summarize their notes. They will learn how to take notes and then summarize their notes after reading a lesson in the science textbook.
- IV. Procedures:**

Activity I: Lead the class through a reading of Chapter 1, Lesson 1. Then, model a think-aloud with information that should be included in each section of the Strategic Notes template. During the think-aloud, share your thinking process with the students by focusing on which information is important and the reasoning to include or exclude particular information. Focus on a few pages from the textbook and model how to select keywords and paraphrase main ideas from the first paragraph again using a think aloud. Then, using the Strategic Notes template, involve students by eliciting their responses. Ask students to determine which keywords they would select from each paragraph and to share reasons for their selections. Pause periodically to help students determine keywords and main ideas. Once the notes are completed, explain to students that they will now learn to summarize their notes. Then, conduct a summarization demonstration and provide students with an oral explanation about the decision that helped to determine how to condense the information into a few clear, succinct sentences.

Activity II: During the next lesson, lead the class in a reading of chapter one/three lesson two. Then, place students in groups of two with a poster size Strategic Notes template. Compose each pair with one who needs more support with someone who is more successful academically. Using Chapter 1, Lesson 2, each partnership will be asked to complete the keywords and main ideas section of the Strategic template. Then, students will work together to write down their summaries in the summary section. Once the information is recorded on the poster paper, partners will be grouped with another

team to share summaries and determine if important information needs to be added or removed in each poster.

Activity III. Have students complete the summarizing notes independently using Chapter 1, Lesson 3. Continue with your usual methods of having students sketch a model of plant and animal cells, and teaching a rap song that reviews the function of organelles.

VI. **Conclusion:** Students complete the Chapter 1 End of Chapter Test, and have them write a reflection on how the summarizing notes study strategy helped them (Exit Ticket).

Class: Classroom B/Teacher B

Course: Science Chapter 1

Materials: Houghton-Mifflin Science Textbook Grade 5, plain paper, pencils, rap song

I. **Class Objectives:** Students will make a sketch of cells and learn a cell function rap song.

II. **Procedures:**

Activity I: Lead the class through a reading of Chapter 1.

Activity II: Have students sketch cells.

Activity III. Teach rap song that reviews the function of organelles.

V. **Conclusion:** Students complete the Chapter 1 End of Chapter Test.

Class: Classroom A/Teacher A

Course: Science Chapter 3

Materials: Houghton-Mifflin Science Textbook Grade 5, butcher paper, pencils

I. Class Objectives: Students will create a drawing of body systems and write an essay about how the body systems are integrated together.

II. Procedures:

Activity I: Lead the class through a reading of Chapter 3.

Activity II: Have students create poster size drawing the a body system.

Activity III: Have students write an essay about how the body systems are integrated.

VI. Conclusion: Students complete the Chapter 3 End of Chapter Test.

Class: Classroom B/Teacher B

Course: Science Chapter 3

Materials: Houghton-Mifflin Science Textbook Grade 5, Strategic Notes template, poster paper, markers, binder and plain paper, pencils

I. Class Objectives: Student will summarize notes, make a drawing of the body systems, and write an essay of how the body systems are integrated

VII. Anticipatory Set: Ask students, “How do you study for a test?” Have some students talk about the ways they study. Tell them they will learn a new way to study for a test.

VIII. Introduction: Tell students they will learn to summarize their notes. They will learn how to take notes and then summarize their notes after reading a lesson in the science textbook.

IX. Procedures:

Activity I: Lead the class through a reading of Chapter 3, Lesson 1. Then, model a think aloud with information that should be included in each section of the Strategic Notes template. During the think-aloud, share your thinking process with the students by focusing on which information is important and the reasoning to include or exclude particular information. Focus on a few pages from the textbook and model how to select keywords and paraphrase main ideas from the first paragraph again using a think aloud. Then, using the Strategic Notes template, involve students by eliciting their responses. Ask students to determine which keywords they would select from each paragraph and to share reasons for their selections. Pause periodically to help students determine keywords and main ideas. Once the notes are completed, explain to students that they will now learn to summarize their notes. Then, conduct a summarization demonstration and provide students with an oral explanation about the decision that helped to determine how to condense the information into a few clear, succinct sentences.

Activity II: During the next lesson, lead the class in a reading of chapter one/three lesson two. Then, place students in groups of two with Strategic Notes template. Compose each pair with one who needs more support with someone who is more successful academically. Using Chapter 3, Lesson 2, each partnership will be asked to complete the keywords and main ideas section of the Strategic Notes template. Then, students will write down their summaries in the summary section. Once the information is recorded on the poster paper, partners will be grouped with another team to share summaries and determine if important information needs to be added or removed in each poster.

Activity III. Have students complete the summarizing notes independently using Chapter 3, Lesson 3. Continue with your usual methods of having students draw the body systems, and having them write an essay of how the body systems are connected.

VI. **Conclusion:** Students complete the Chapter 3 End of Chapter Test, and have them write a reflection on how the summarizing notes study strategy helped them (Exit Ticket).

Appendix F
Fifth Grade Science Short Answer Rubric

Rubric

DIRECTIONS: Please use the following rubric to score short answer questions on assessments.

4	The student has demonstrated a thorough understanding of the scientific concepts. The student has provided clear and complete explanations and interpretations. The response may contain minor flaws that do not detract from a demonstration of a thorough understanding.
3	The student has demonstrated an understanding of the scientific concepts. The student's response is essentially correct, but the scientific explanations and/or interpretations provided are not thorough. The response may contain minor flaws that reflect inattentiveness or indicate some misunderstanding of the underlying scientific concepts.
2	The student has demonstrated only a partial understanding of the scientific concepts. Although the student may have arrived at an adequate interpretation or acceptable conclusion, the student's work lacks an essential understanding of the underlying scientific concepts. The response may contain errors related to misunderstanding important aspects of the scientific concepts.
1	The student has demonstrated a very limited understanding of the scientific concepts. The student's response is incomplete and exhibits many flaws. Although the student's response has addressed some of the concepts, the student has reached an inadequate conclusion and or provided reasoning that is faulty or incomplete. The response exhibits many flaws or may be incomplete.
0	The student has not provided a response or has provided a response that does not demonstrate an understanding of the scientific concepts. The student's explanation may be uninterpretable, lack sufficient information to determine the student's understanding, contain clear misunderstandings of the underlying scientific concepts, or may be incorrect.

References:

Florida Department of Education, Assessment and School Performance. (2006). *Report on the 2006 Florida Comprehensive Assessment Test*. Retrieved from http://fcats.fldoe.org/pdf/FL06_Inquires_final_tagged.pdf

Appendix G
Fifth Grade Summary Writing Rubric

	ADVANCED-4	PROFICIENT-3	MAKING PROGRESS-2	NEEDS IMPROVEMENT-1
Summary	<ul style="list-style-type: none"> Paraphrases main idea(s) and significant details 	<ul style="list-style-type: none"> Includes main idea(s) and supporting details 	<ul style="list-style-type: none"> May include main idea(s) and a few details Retells article or story 	<ul style="list-style-type: none"> Lacks main idea(s) May retell parts of the article or story
Organization & Focus	<ul style="list-style-type: none"> Clearly addresses all parts of the writing task Includes a topic sentence with the main idea of the article or story Uses significant details Stays clearly focused on the main idea 	<ul style="list-style-type: none"> Addresses all parts of the writing task Includes the main idea of the article or story Provides supporting details Generally stays focused on the main idea 	<ul style="list-style-type: none"> Addresses only parts of the writing task The main idea may be partially included The details included are elements in a retell 	<ul style="list-style-type: none"> Addresses only one part or none of the writing task Main idea is not included Lacks details from the article or story
Written Conventions	<ul style="list-style-type: none"> Includes a variety of sentence types Contains few or no errors in the conventions of the English language (grammar, punctuation, capitalization, spelling). These errors do not interfere with the reader's understanding of the writing. 	<ul style="list-style-type: none"> Includes a variety of sentence types Contains some errors in the conventions of the English language (grammar, punctuation, capitalization, spelling). These errors do not interfere with the reader's understanding of the writing. 	<ul style="list-style-type: none"> Includes little variety in sentence types Contains several errors in the conventions of the English language (grammar, punctuation, capitalization, spelling). These errors do not interfere with the reader's understanding of the writing. 	<ul style="list-style-type: none"> Includes no sentence variety Contains serious errors in the conventions of the English language (grammar, punctuation, capitalization, spelling). These errors interfere with the reader's understanding of the writing.

References

Berryessa Union School District, Summary Writing Rubric 4th-5th Grade. (2015). Retrieved from <http://www.berryessa.k12.ca.us/OUR-DISTRICT/Education-Services/Assessment--DATA/District-Assessments/Writing-Rubrics/>

Appendix H
Child Assent Form

Child Assent Form

We are doing an experiment to learn about student study strategies. We are asking you to help because we don't know very much about whether kids your age use study strategies.

If you agree to be in our study, we are going to ask you to participate in a lesson where you have to take notes and summarize. We want to know if this study strategy helps you in getting a good score/grade on your science test.

You can ask questions about this study at any time. If you decide at any time not to participate, you can tell us you do not want your information to be part of the study.

If you sign this paper, it means that you have read this and that you want to be in the study. If you don't want to be in the study, don't sign this paper. Being in the study is up to you, and no one will be upset if you don't sign this paper or if you change your mind later.

Your signature: _____ Date _____

Your printed name: _____ Date _____

Signature of person
obtaining consent: _____ Date _____

Printed name of person
obtaining consent: _____ Date _____

Appendix I
Strategic Notes Template

Name _____ Date: _____

Topic:	What you know:
Main Points: <ul style="list-style-type: none">••••••	
Summary:	
New Vocabulary: <ul style="list-style-type: none">••••	

Appendix J
Chapter 1 End of Chapter Test

Name _____ Date _____

A.1
Chapter Benchmark
Test**Chapter Test****Reviewing Vocabulary**

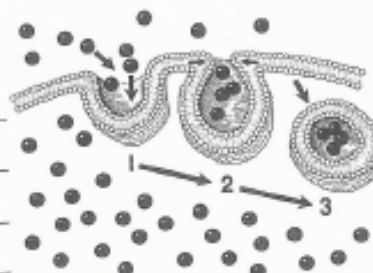
1. A _____ is the basic unit that makes up living things.
2. The process of breaking down glucose in cells is called _____.
3. A group of similar specialized cells is a _____.
4. The _____ is the cell part that directs the activities of the cell.
5. A group of related organs that work together to perform a specific function is an _____.
6. The _____ is a thick fluid between the nucleus and cell membrane.
7. _____ is a process that spreads substances through a gas or liquid.
8. _____ are structures that perform specific functions in a cell.
9. An _____ is a group of related tissue that performs a specific function.
10. _____ is the diffusion of water across a membrane.

Name _____ Date _____

A.1
Chapter Benchmark
Test

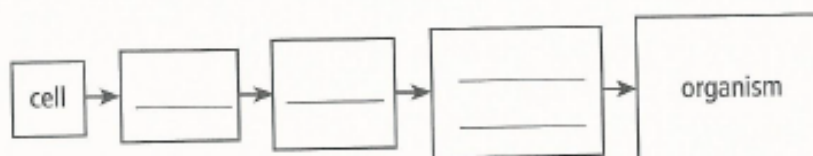
Checking Main Ideas

11. What type of transport is shown in this picture? How do you know?



12. What are four reasons that cells need energy?

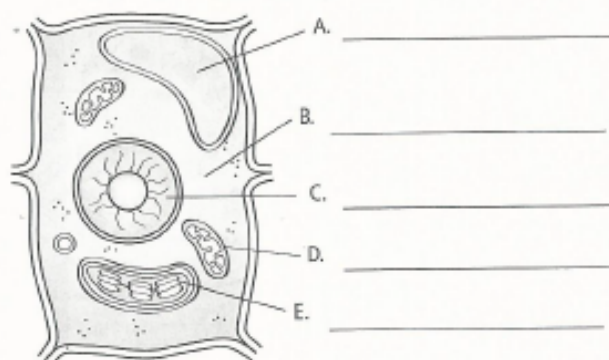
13. Fill in the missing parts of the organizer about cell organization.



14. What happens in cellular respiration?

Name _____ Date _____

15. Label the parts of the cell.

**Using Inquiry Skills**

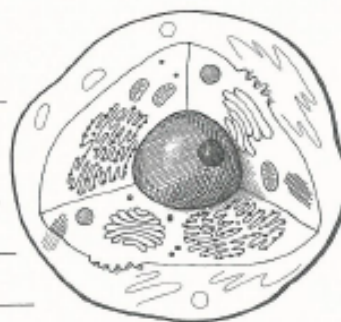
16. **Infer** A cucumber was sliced up. One slice was placed in a cup of fresh water. Another slice was placed in a cup of salt water. The next day, the texture of the cucumber in the salt water was different than the texture of the cucumber in the fresh water. Explain the results.

17. **Use Variables** In the experiment described above, what is the independent variable?

Name _____ Date _____

A.1
Chapter Benchmark
Test**Thinking Critically**

- 18. Analyze** What kind of cell is this? How do you know?



- 19. Synthesize** How are organs similar to organelles? How are they different?

- 20. Generate Ideas** How can an unhealthy digestive system affect the other organ systems in an animal?

References

Badders, W., Carnine, D., Feliciani, J., Jeanpierre, B., Sumners, C., & Valentino, C.
(2007). *California Science*. Boston: Houghton Mifflin Company.

Appendix K
Chapter 2 End of Chapter Test

Name _____ Date _____

A.2
Chapter Benchmark
Test**Chapter Test****Reviewing Vocabulary**

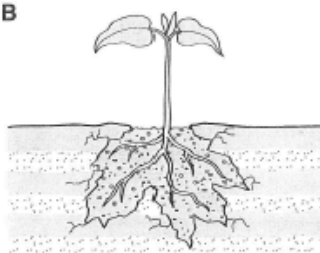
1. _____ is a plant process that transforms sunlight's energy into chemical energy in food.
2. A _____ is the organelle in which photosynthesis occurs.
3. The most important pigment in a chloroplast is _____.
4. _____ are the membranes in chloroplasts that look like flat stacks.
5. The vascular tissue that conducts sugar in plants is called _____.
6. Plants without vascular tissue are called _____.
7. _____ are small openings on the underside of a leaf.
8. _____ is the vascular tissue that conducts water and minerals in plants.
9. _____ is a process in which liquid water evaporates through plant leaves.
10. A _____ has specialized tissues that transport materials throughout the plant.

Word Box

chloroplast	phloem	photosynthesis	grana
nonvascular plants	chlorophyll	stomata	
xylem	vascular plant	transpiration	stomata

Name _____ Date _____

A.2
Chapter Benchmark
Test**Checking Main Ideas****11.** What do stomata do for a plant?

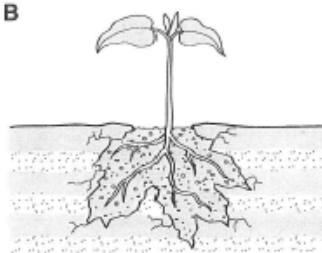
12. How is a plant in A similar to the plant in B? How are they different?**A****B**

13. What raw materials does a plant need for photosynthesis? What materials are produced during photosynthesis?

14. How is phloem different from xylem?

Name _____ Date _____

A.2
Chapter Benchmark
Test**Checking Main Ideas****11.** What do stomata do for a plant?

12. How is a plant in A similar to the plant in B? How are they different?**A****B**

13. What raw materials does a plant need for photosynthesis? What materials are produced during photosynthesis?

14. How is phloem different from xylem?

Name _____ Date _____

A.2
Chapter Benchmark
Test**Using Inquiry Skills**

- 15. Draw Conclusions** Dylan stood two stalks of celery in two cups of blue water. He placed one cup in a sunny spot and one in a dark corner. The top of the stalk in the sun turned blue before the top of the other stalk. What conclusions can you draw from this result?

Use the table to answer questions 16 and 17.

Tree Rings

Year	Width of Ring (cm)
1982	1.42
1983	1.36
1984	2.19
1985	3.27
1986	3.02
1987	2.45
1988	2.31
1989	2.81
1990	2.67
1991	3.99
1992	3.75
1993	4.05
1994	3.51

- 16. Interpret Data** In what year did the tree grow the least? In what year did it grow the most?

- 17. Infer** What might cause the differences in the widths of the tree rings?

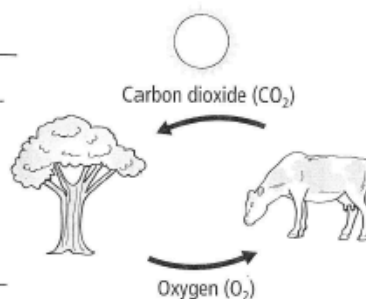
Name _____ Date _____

A.2
Chapter Benchmark
Test**Thinking Critically**

- 18. Synthesize** In the fall the leaves of some trees change color, and then fall off. How would this affect a tree's ability to make food?

- 19. Apply** How might a large number of houseplants affect a room?

- 20. Analyze** Use the diagram to explain how carbon dioxide and oxygen cycle on earth.



Appendix L
Chapter 3 End of Chapter Test

Name _____ Date _____

A.3
Chapter Benchmark
Test**Chapter Test****Reviewing Vocabulary**

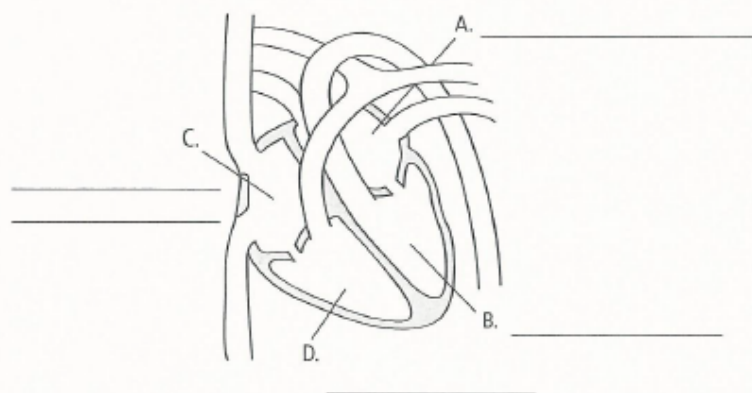
Match the vocabulary word to its definition.

- | | |
|---|-----------------------|
| _____ 1. a pair of bean-shaped organs located near the middle of the back | a. artery |
| _____ 2. a muscular tube that pushes food toward the stomach | b. digestive system |
| _____ 3. a muscular organ at the center of the circulatory system | c. heart |
| _____ 4. carries oxygen and nutrients to all the cells of your body | d. stomach |
| _____ 5. a blood vessel that carries blood away from the heart | e. esophagus |
| _____ 6. a blood vessel that carries blood back to the heart | f. kidneys |
| _____ 7. a group of organs that work together to break down food into smaller pieces the body can use | g. circulatory system |
| _____ 8. a muscular organ that mixes and stores food and turns it into a soupy mix | h. capillaries |
| _____ 9. removes waste and maintains water balance | i. excretory system |
| _____ 10. tiny, very thin blood vessels | j. vein |

Name _____ Date _____

A.3
Chapter Benchmark
Test**Checking Main Ideas**

11. Label each chamber of the heart.



12. What system moves gases into and out of the body?

- a. excretory
- b. digestive
- c. respiratory
- d. circulatory

13. Enzymes in saliva change

- a. solid food to liquid.
- b. starch to sugar.
- c. oxygen to carbon dioxide.
- d. salt to carbohydrates.

14. The central vacuole of a plant cell

- a. produces sugar.
- b. releases oxygen to the air.
- c. carries nutrients to the leaves.
- d. stores wastes.

Name _____ Date _____

A.3
Chapter Benchmark
Test
Using Inquiry Skills

- 15. Compare** How does your pulse rate differ when you are resting and when you are exercising? Explain what causes this difference.

Use the information in the table below to answer question 16.

	grams of fat	grams of protein	grams of carbohydrates	milligrams of cholesterol	grams of saturated fat
spaghetti	1	7	39	0	0.1
steak	15	23	0	77	6.4
brown rice	1	5	50	0	0.4
pecan pie	32	7	71	569	4.7
chocolate shake	9	9	60	30	4.8
tofu	5	9	3	0	0.7
celery	0	1	4	0	0
carrot	0	1	7	0	0

- 16. Analyze Data** Would a marathon runner be wiser to eat steak or spaghetti before a long race? Explain your choice.

Name _____ Date _____

A.3
Chapter Benchmark
Test**Thinking Critically**

- 17. Synthesize** A giraffe eats tree leaves. A lion eats other animals. What could you conclude about the length and complexity of the digestive system of each animal? Explain your answer.

- 18. Apply** What role do muscles play in the digestion of food?

- 19. Analyze** What role of the kidneys does a dialysis machine carry out?

- 20. Evaluate** What do the gills of a fish have in common with alveoli in a human?

Badders, W., Carnine, D., Feliciani, J., Jeanpierre, B., Sumners, C., & Valentino, C.
(2007). *California Science*. Boston: Houghton Mifflin Company.

Appendix M
Chapter 6 End of Chapter Test

Name _____ Date _____

**C.6
Chapter Benchmark
Test****Chapter Test****Reviewing Vocabulary**

1. _____ is the overall condition of the atmosphere at a given time and place.
2. The force exerted by air on a given area is known as _____.
3. Earth's _____ is a mixture of gases that surrounds the planet.
4. As warm air rises from mountain slopes, cooler air from the valley below moves up the slope to replace it, creating a(n) _____.
5. The movement of air from land toward water is a(n) _____.
6. Differences in air pressure in the global pressure belts result in _____.
7. A(n) _____ is a large body of air that has about the same temperature and moisture conditions throughout.
8. A weather _____ is the boundary between two air masses with different properties.
9. A(n) _____ is a scientist who studies weather.
10. Lightning, gusty winds, and heavy rain are all associated with a(n) _____.

Word Box

air mass air pressure atmosphere front land breeze
meteorologist planetary winds thunderstorm valley breeze weather

Name _____ Date _____

**C.6
Chapter Benchmark
Test****Checking Main Ideas**

11. Narrow belts of fast-moving winds in the upper troposphere are called
- a. local winds.
 - b. trade winds.
 - c. jet streams.
 - d. tornadoes.
12. What tool is used to measure wind speed?
- a. anemometer
 - b. barometer
 - c. thermometer
 - d. rain gauge
13. The most powerful storms on Earth are
- a. thunderstorms.
 - b. blizzards.
 - c. tornadoes.
 - d. hurricanes.
14. Global pressure belts are caused by
- a. Earth's rotation.
 - b. a large, cold air mass.
 - c. uneven heating of Earth's surface.
 - d. the distance between Earth and the Sun.

Name _____ Date _____

C.6
Chapter Benchmark
Test
Using Inquiry Skills

- 15. Analyzing Data** For 3 consecutive days Rudi studies weather maps. She observes that a fast-moving cold front should move into her region soon. What changes in the local weather can she expect?

- 16. Predict** What can you predict about the general characteristics of an air mass that forms over the Gulf of Mexico?

- 17. Compare** Fill in the chart to show how a sea breeze and a valley breeze are alike and different.

	Sea Breeze	Valley Breeze
Caused by	<hr/> <hr/>	<hr/> <hr/>
When felt	<hr/> <hr/>	<hr/> <hr/>
Direction	<hr/> <hr/>	<hr/> <hr/>

Name _____ Date _____

C.6
Chapter Benchmark
Test**Thinking Critically**

- 18. Evaluate** Your family lives in a California town at the base of the western edge of a coastal mountain range. Your best friend lives a few kilometers away on the other side of the mountain range. How do the climates of your two towns differ?

- 19. Synthesize** Your class sets up a weather station in your school yard. After a few days, someone observes that the temperature readings at your station are quite a bit higher than those reported by the local weather station. What might cause this difference and what changes might you make to correct the situation?

- 20. Analyze** On a warm, sunny, breezy day, you and a friend go to the shore to fly kites. Your friend is afraid that the kites might get tangled in some wires near the parking lot. You say the kites will fly safely over the water. Who is right? Explain.
